MARITIME GEOTHERMAL LTD.

Installation and Service Manual

TF-Series

Modular Design
Two-Stage R410a
Model Sizes 45-80 (3-6 Ton)

Triple Function Geothermal Heat Pumps

LEFT RETURN RIGHT RETURN

ENERGY STAR

AHRI CERTIFIED™ www.ahridirectory.org
Water Source HP
ANSI/AHRI/ASHRAE/ISO13256-1

CE

C SA US

Maritime Geothermal Ltd.
P.O. Box 2555
Petitcodiac, N.B. E4Z 6H4
Ph. (506) 756-8135

Email: info@nordicghp.com
Web: www.nordicghp.com

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SAFETY PRECAUTIONS

WARNING: **Ensure all access panels are in place and properly secured before applying power to the unit. Failure to do so may cause risk of electrical shock.**

WARNING: **Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED. Electrical shock can cause serious personal injury or death.**

WARNING: **Heat pump systems contain refrigerant under high pressure and as such can be hazardous to work on. Only qualified service personnel should install, repair, or service the heat pump.**

CAUTION: **Safety glasses and work gloves should be worn at all times whenever a heat pump is serviced. A fire extinguisher and proper ventilation should be present whenever brazing is performed.**

CAUTION: **Venting refrigerant to atmosphere is illegal. A proper refrigerant recovery system must be employed whenever repairs require removal of refrigerant from the heat pump.**

MODEL NOMENCLATURE

TF—65—HACW—P—1T—CC—SDERF—xx

Series:
TF = Active Cooling Liquid to Air & Liquid To Water

Nominal Size:
45 = 3 Ton
55 = 4 Ton
65 = 5 Ton
75 = 6 Ton
80 = 6 Ton Single Stage

Functions:
H = Heating
AC = Active Cooling
W = Domestic Hot Water

Refrigerant:
P = R410a

Voltage Code:
1 = 230-1-60 VAC
2 = 208-3-60 VAC
6 = 220-1-50 VAC
7 = 380-3-50 VAC

Compressor Stages*:
S = 1 Stage
T = 2 Stage
* 2 stage unless unavailable due to voltage code, refer to the **Electrical Tables**.

Revision:
01, 02 etc.

Fan Outlet Orientation:
D = Down flow
F = Field Configurable

Fan Return Orientation:
L = Left Return
R = Right Return

Fan Motor:
E = ECM (Variable Speed)

Fan Type:
D = Direct Drive

Air Coil:
S = Standard

Indoor Loop Exchanger:
C = Copper
Z = Cupro-Nickel (CuNi)

Outdoor Loop Exchanger:
C = Copper
Z = Cupro-Nickel (CuNi)

APPLICATION TABLE

SIZE	FUNCTION	REFRIGERANT	VOLTAGE	STAGES	OUTDOOR COIL	INDOOR COIL	FAN/CASE	REVISIONS				
45	HACW	P	1	T	C Z	C Z	SDELF SDERF	13				
			2	T				13				
			6	S				13				
			7	T				13				
55	HACW	P	1	T	C Z	C Z	SDELF SDERF	13				
			2	T				13				
			6	S				13				
			7	T				13				
65	HACW	P	1	T	C Z	C Z	SDELF SDERF	13				
			2	T				13				
			6	S				13				
			7	T				13				
75	HACW	P	1	T	C Z	C Z	SDELF SDERF	13				
			2	T				13				
			6	S				13				
			7	T				13				
80	HACW	P	1	S	C Z	C Z	SDELF SDERF	13				
			2	S				13				
			7	S				13				

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UNIT DESCRIPTION

The TF-Series unit is a high efficiency two-stage geothermal heat pump with environmentally friendly R410a refrigerant. Two-stage units offer longer runtimes and fewer cycles resulting in higher efficiency and a higher comfort level. It has three modes of operation: air heating, air cooling or hydronic heating.

NOTE: Air heating and hydronic heating cannot be accomplished simultaneously.

An electrically commutated (ECM) fan with several speed options is standard. The motor has a soft start function for improved efficiency and reduced wear.

The unit has several key features that are described in the specifications document for the particular heat pump. Please request a copy if desired or visit **www.nordicghp.com**

UNPACKING THE UNIT

When the heat pump reaches its destination it should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a suitable claim filed at once. The heat pump is well constructed and every effort has been made to ensure that it will arrive intact, however it is in the customer's best interest to examine the unit thoroughly when it arrives.

OPTIMUM PLACEMENT

For liquid to air units, to achieve the greatest efficiency, the heat pump should be centrally located in the home with respect to the conditioned space. This design provides the utmost in economy and comfort and usually can be accomplished in harmony with the design of the home. A heating system cannot be expected to produce an even warmth throughout the household when it is located at one end of the structure and the warm air is transmitted with uninsulated metal ductwork.

If possible the access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance.

Raising the heat pump off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit. We recommend that the heat pump be placed on a piece of 2" thick styrofoam. The styrofoam will smooth out any irregularities in the cement floor and deaden any compressor noise emitted from the bottom of the cabinet.

The heat pumps come equipped with an air-filter rack which can be installed with the removable end (where the filter is inserted) on either side to facilitate changing the filter.

ELECTRICAL CONNECTIONS

The heat pump has a concentric 1.093" / 0.875" knockout for power supply connection to the electrical box. There is also a 0.875" knockout for connection to the circulator pump module for ground loop applications. There are two 1/2" openings with plastic grommets (grommet hole is 3/8") in the upper section of the electrical box, one for the thermostat connections, and one for the optional plenum heater connections.

A schematic diagram (SCH) and electrical box layout diagram (ELB) can be found inside the electrical box cover of the unit as well as in the Model Specific section of this manual. The Electrical Tables in the Model Specific section and the ELB diagram contain information about the size of wire for the connections, as well as the recommended breaker size. **A properly qualified electrician should be retained to make the connections to the heat pump and associated controls. The connections to the heat pump MUST CONFORM TO LOCAL CODES.**

CIRCULATOR PUMP MODULE WIRING (GROUND LOOP ONLY)

The heat pump has provisions for connecting the circulator pump module so that the pumps will be turned on whenever the compressor operates. Connect the circulator pump module to the appropriate two terminals of the terminal strip marked **OUTDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump module. Ensure that the total current draw does not exceed the value indicated on the label in the heat pump electrical box. Refer to the electrical box drawing on the electrical box cover for more information.

INDOOR LOOP CIRCULATOR WIRING

The Indoor Loop circulator provides flow between the heat pump and the buffer tank. The heat pump has provisions for connecting the Indoor Circulator so that it will be turned on whenever the compressor operates. Connect the Indoor Loop circulator to the appropriate two terminals of the terminal strip marked **INDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump module. Ensure that the total current draw of all pumps connected to the terminal strip does not exceed the value indicated on the label in the heat pump electrical box. Refer to the electrical box drawing on the electrical box cover for more information.

THERMOSTAT REQUIREMENTS

The TF-Series unit requires a three-stage heating and two stage cooling thermostat for proper forced air operation. The stages are S1 = Stage 1 compressor, S2 = Stage 2 compressor and S3 = electric auxiliary (heating only). One can be purchased with the unit, or other thermostats with the same number of stages can be used. The electrical box diagram (ELB) on the electrical box cover pro- vides a description of the signal connections as does **TABLE 1**.

TABLE 1 - Thermostat Signal Description

Signal	Description
C	24VAC Common (Ground)
G	Fan low speed (for air circulation)
Y_1	Heat Pump Stage 1 Air
R_H	24VAC Hot
L	Fault (24VAC when fault condition)
W_2	Heat Pump Stage 3 Air (auxiliary heat) / Emergency Heat
O	Cooling Mode (reversing valve)
Y_2	Heat Pump Stage 2 Air
AR_1	Airflow Reduction*
AR_2	Airflow Reduction*
I	Plenum Heater dry contact
1	Plenum Heater dry contact

* Connect AR_1 to AR_2 with a dry contact to reduce the airflow by 15%. Refer to the Fan Motor sub-section for more information.

NOTE: Some models are not available in two-stage at the present time (see Electrical Tables). The Y2 signal is not used for these units.

AQUASTAT REQUIREMENTS

The heat pump requires a two-stage aquastat for proper hydronic operation. The stages are S1 = low speed, and S2 = high speed.

A two-stage aquastat can be purchased with the unit, or other system controllers with dry contacts may be used. This manual covers operation of the heat pump with an aquastat.

The aquastat connection diagram (CDG) can be found near the end of this manual and on the electrical box cover of the unit. It provides a description of the signal connections in the heat pump. They are also listed in **TABLE 2**.

TABLE 2 - Aquastat Signal Description

Signal	Description
Y2A	**Heat Pump Stage 2 Hydronic**
Y1A	**Heat Pump Stage 1 Hydronic**
RA	**24VAC Hot**
CA	**24VAC Common (Ground)**

The aquastat can be placed anywhere within the range of the probe cable. The probe(s) should be inserted into a dry well in or near the top of the tank for optimal operation **(refer to drawing 000533PDG)** . If a dry well is not available, it may be possible to fix the probe to the tank inside the insulation.

TABLE 3 shows typical settings for the aquastat. With these settings, Stage 1 will activate when the tank temperature reaches the activation point. If the load is too great, the tank temperature will continue to drop until Stage 2 is activated. As the tank temperature stops dropping and begins to increase , Stage 2 will turn off before Stage 1, rather than at the same time as Stage 1. There are three main advantages to this:

- Less aquastat probe lag leading to reduced overshoot as the tank temperature rate of change is reduced when only Stage 1 is active.
- Prolonged Stage 1 runtime leads to increased overall efficiency as Stage 1 has a higher COP than Stage 2.
- Reduced number of compressor starts.

The settings may be changed as desired; however Stage 1 setpoint should not exceed **120°F (49°C)**; Exceeding this setpoint limit will cause the heat pump operating pressures to approach the safety control settings, possibly causing nuisance shut downs.

TABLE 3 - Typical Aquastat Settings

	Stage 1		Stage 2	
Item	**°F**	**°C**	**°F**	**°C**
Setpoint	**115**	**46**	**105**	**41**
Delta	**5**	**3**	**5**	**3**
Activation *	**110**	**43**	**100**	**38**
*Activation is indirectly set by the Setpoint and Delta values				

If only floor zones are being heated, it is highly recommended to drop each of the setpoints by 15°F (8°C) for increased efficiency.

It is recommended that a buffer tank with electric elements be selected to provide auxiliary / backup heat. The tank element thermostats can be set to a low value of around 60F (15C) which will prevent the hydronic system from becoming too cold should there be a failure in the heating system.

Drawing 000344CDG shows how a typical zone system would be setup with the TF unit. The zone controls and heat pump operate independently, there are no connections between the two systems.

PRIORITY SLECTION

Units are shipped setup for air priority. To convert to hydronic priority, simply remove the jumper wire between the two PR terminals on the aquastat terminal strip. See the electrical box & schematic diagrams for more information.

OPERATIONAL DESCRIPTION

The TF unit is designed to deliver heat to the mode that requires it the most. Once the default priority has been selected, the unit will interpret the control signals and deliver heat based on logic described below. This logic can also be seen in **TABLE 4** and **TABLE 5**, in a truth table format or in **DIAGRAM A** and **DIAGRAM B** in flowchart format. Simply put, whenever there is a call on both air and hydronic, the unit steps up to Stage 2 of the priority mode (if it was not already there) in order to satisfy the demand quickly and return to the non-priority mode.

SINGLE MODE OPERATION:

If there is only an air mode call (Y1 and/or Y2 and/or W2) the unit operates in air mode as Stage 1, Stage 2 or Stage 3.

If there is only a hydronic mode call (Y1 and/or Y2) the unit operates in hydronic mode as Stage 1 or Stage 2.

AIR MODE PRIORITY OPERATION:

If there is a call for both Stage 1 air and Stage 1 hydronic, the unit operates in Air Mode as Stage 2.

If there is a call for both Stage 2 air and Stage 1 hydronic, the unit operates in Air Mode as Stage 2.

If there is a call for both Stage 2 air and Stage 2 hydronic, the unit operates in Air Mode as Stage 2.

HYDRONIC MODE PRIORITY OPERATION:

If there is a call for both Stage 1 air and Stage 1 hydronic, the unit operates in Hydronic Mode as Stage 2.

If there is a call for both Stage 2 air and Stage 1 hydronic, the unit operates in Hydronic Mode as Stage 2.

If there is a call for both Stage 2 air and Stage 2 hydronic, the unit operates in Hydronic Mode as Stage 2.

NOTES:

Stage 3 (W2) of Air Mode overrides Hydronic Mode even if Hydronic Mode has priority. This unit functions this way because either the air temperature has dropped significantly in order to reach Stage 3 or the thermostat has been set to Emergency Mode.

The fan can operate in recirculation mode (G) only if there is not a hydronic Stage 1 (Y1A) signal present, regardless of priority selection.

TABLE 4 - TF Control System Truth Table (Air Priority)

CONTROLS					SYSTEM OPERATION				
Thermostat			Aquastat		AIR MODE STAGE 1	AIR MODE STAGE 2*	AIR MODE STAGE 3	HYDRONIC STAGE 1	HYDRONIC STAGE 2
STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2					
X					X				
X	X					X			
X	X	X				X	X		
			X					X	
			X	X					X
X			X			X			
X	X		X			X			
X	X		X	X		X			
X	X	X				X	X		
X	X	X	X			X	X		
X	X	X	X	X		X	X		
		X**					X**		

* An X in both Stage 2 and Stage 3 indicates that the compressor and plenum heat are active.
** This is emergency heat situation. Only the plenum heater is active.

TABLE 5 - TF Control System Truth Table (Hydronic Priority)

CONTROLS					SYSTEM OPERATION				
Thermostat			Aquastat		AIR MODE STAGE 1	AIR MODE STAGE 2*	AIR MODE STAGE 3	HYDRONIC STAGE 1	HYDRONIC STAGE 2
STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2					
X					X				
X	X					X			
X	X	X				X	X		
			X					X	
			X	X					X
X			X						X
X	X		X						X
X	X		X	X					X
X	X	X				X	X		
X	X	X	X			X	X		
X	X	X	X	X		X	X		
		X**					X**		

* An X in both Stage 2 and Stage 3 indicates that the compressor and plenum heat are active.
** This is emergency heat situation. Only the plenum heater is active.

DIAGRAM A - TF CONTROL SYSTEM FLOW CHART (AIR PRIORITY)

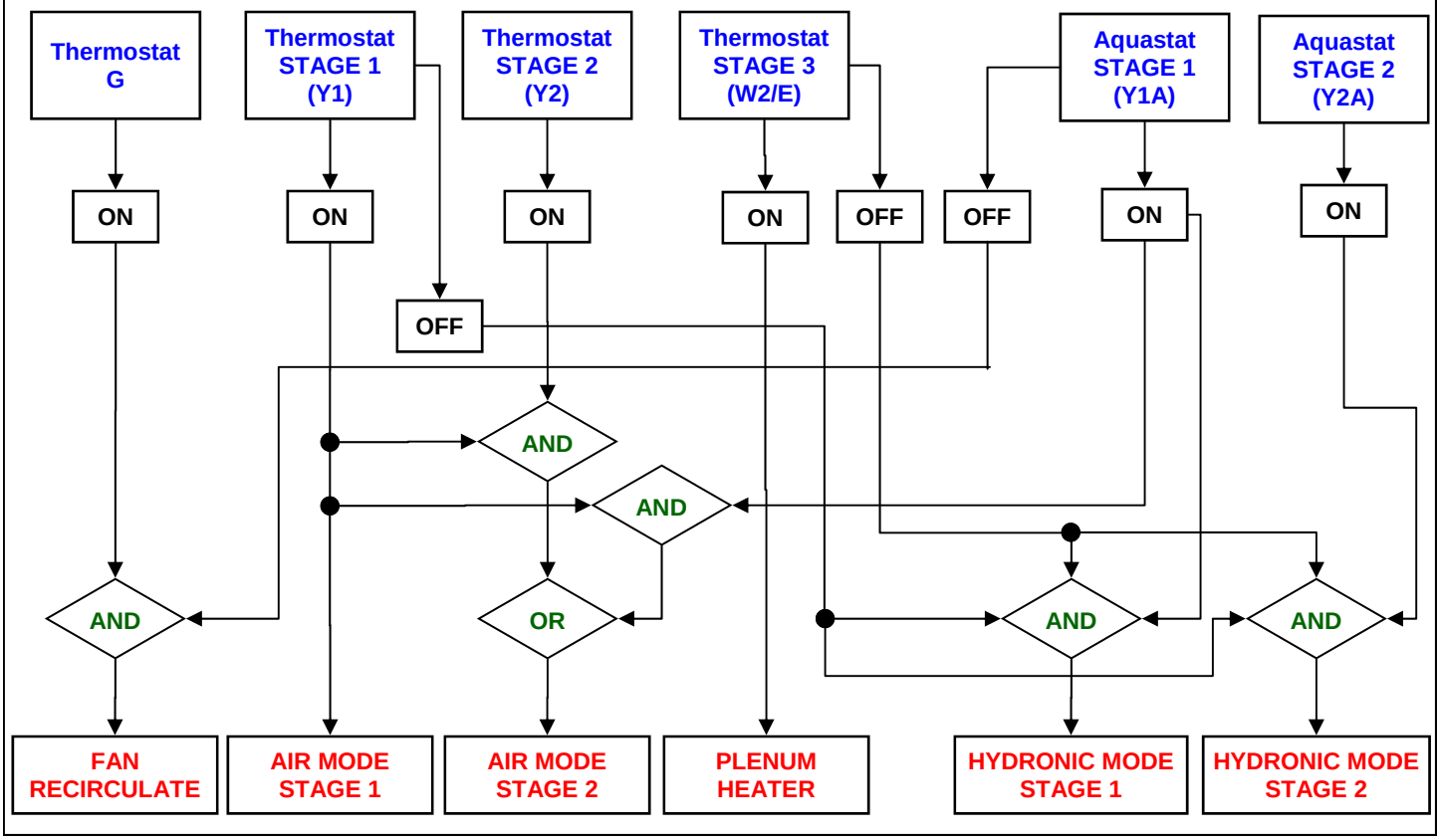
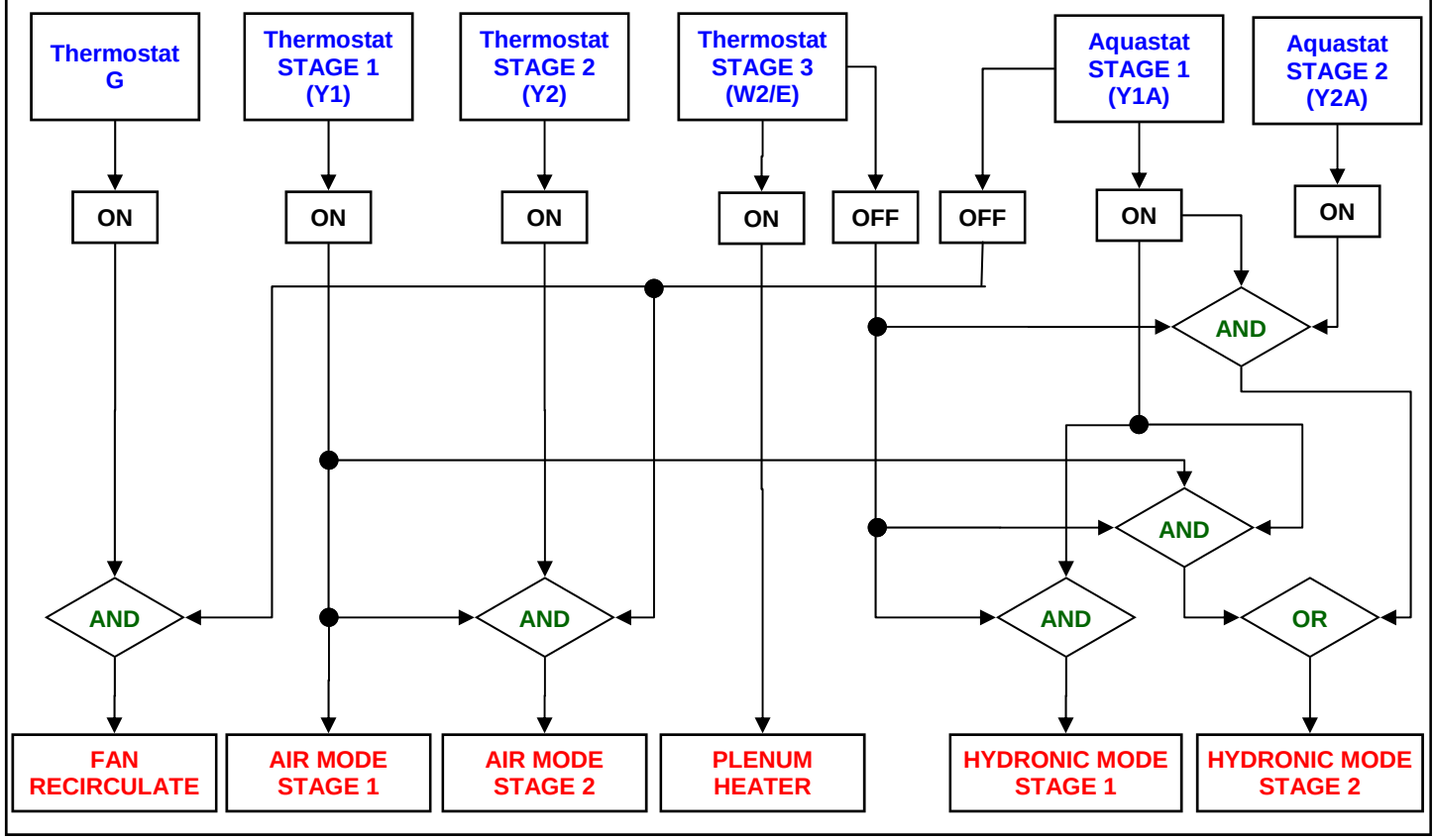


DIAGRAM B - TF CONTROL SYSTEM FLOW CHART (HYDRONIC PRIORITY)



FAN MOTOR

The unit is equipped with a direct drive ECM fan motor for maximum efficiency. The motor features a soft start which further improves efficiency by eliminating inrush current and provides a smooth, quiet ramp up to speed . The motor will maintain the programmed air flow up to the maximum external static value. Refer to the **APPENDIX B: ECM Fan Airflow Tables.**

The air flow can be set to four different levels by changing the position on the Air Flow board located in the electrical box. The four levels are indicated in **TABLE 6**. The actual air flow values can be found in **APPENDIX B**.

TABLE 6 - Airflow Selections

Position	Airflow
LOW	-6%
MED	Nominal
HIGH	+6%
MAX	+12%

Units are shipped with the **MED** position selected for nominal air flow. The air flow can be further reduced by 15% by making a dry contact across AR_1 and AR_2 on the terminal strip. This can be used for applications that have multiple zones, or retrofits with undersized ductwork, to help reduce air flow noise in the ductwork. It is recommended that airflow reduction only be used with the High or Max air flow setting. Care should be taken to ensure that the unit does not trip a safety control in heating or cooling mode if the 15% reduction is used in conjunction with the MED or LOW air flow setting.

FAN RETURN ORIENTATION

The TF-Series heat pump can be ordered as a left or right hand return from the factory. This must be specified at time of order as the physical construction of the two configurations is different. Refer to the specification documents for more details.

FAN OUTLET ORIENTATION

The TF-Series heat pumps have a field configurable fan. It's default location from the factory is in the top of the unit, providing a "ninety" in the airflow. It can easily be placed in the side of the unit for straight through airflow.

To switch the location of the fan outlet follow these simple steps:

1. Turn the power of to the unit.
2. Remove the screw that holds the side access panel in place and remove the access panel by pulling up on the handle and then outward from the bottom.
3. Disconnect the two wire harnesses and ground wire from the fan motor.
4. Repeat step 2 for the access panel with the fan mounted in it. Set the assembly on the floor.
5. Disconnect the plenum heater extension from the fan housing and from the access panel.
6. Mount the fan housing directly to the access panel.
7. Install the fan/panel in the new location and secure with the screw.
8. Reconnect both harnesses and ground wire.
9. Install the remaining access panel and secure with the remaining screw.

CONTROL TRANSFORMER

The low voltage controls are powered by a 75VA class II transformer. The transformer has a resettable breaker on the secondary side for circuit protection. Should the breaker trip, locate and correct the problem and then reset the breaker by pressing in on it.

NOTE: For 208/230VAC-1-60 units, if connecting to 208VAC power supply move the red wire connected to the 240 terminal of the transformer to the 208 terminal of the transformer.

SAFETY CONTROLS

The heat pump has two built in safety controls which are designed to protect the unit from situations which could damage it should the operation of the refrigeration circuit fall outside the allowable operating range.

A. Low Pressure Control

The low pressure control monitors the compressor suction pressure and will shut the compressor down if the refrigerant evaporating pressure becomes too low, risking the danger of freezing conditions in the evaporator.

There are (3) main reasons why this control would activate in response to the operating conditions of the unit while operating in heating mode:

1. Low or no Outdoor loop flow.
2. Low Outdoor loop entering liquid temperature.
3. Dirty or fouled Outdoor loop heat exchanger.

B. High Pressure Control

The high pressure safety control monitors the compressor discharge pressure and will shut the compressor down if the condensing pressure becomes too high.

There are (3) main reasons why this control would activate in response to the operating conditions of the unit while operating in heating mode:

1. Low or no airflow.
2. High return air temperature.
3. Dirty air coil due to poor filter maintenance.

The unit contains a control board that monitors the safety controls and operates the compressor accordingly. Refer to **APPENDIX A** for control board specifications. The low pressure control is connected to LP1 and LP2. The high pressure control is connected to HP1 and HP2.

The control board also has provisions for a flow switch. The flow switch is unused from the factory and a jumper wire is placed across the FLOW SWITCH terminals. If a flow switch is desired, the jumper can be removed and the two leads from the flow switch can be connected to the FLOW SWITCH terminals on the safety board. The flow switch is ignored for 30 seconds on compressor startup to allow time for flow to be established. The high and low pressure controls are monitored at all times. The compressor will not be able to start if either of them has a fault.

The control board has an on-board LED and a FAULT pin with a 24VAC output. An external indicator or relay can be connected across the FAULT pin and ground if external signaling is desired. Should a fault occur, the LED will flash the code of the fault condition while the safety control in question is open. The codes are shown in **TABLE 7.** The control board will lock

out the compressor for five minutes when a fault occurs. Three retries per fault condition are allowed within a 60 minute period. If the fault condition occurs a fourth time the control board will permanently lock out the compressor and energize the FAULT pin. This can only be reset by powering down the unit. The LED will flash the fault code until the unit is reset.

If the control board enters permanent lockout mode there is a serious problem with the system and it must be rectified if the unit is to maintain good service.

TABLE 7 - Control Board Fault Codes

Fault	Code
High Pressure	1
Low Pressure	2
Flow	3

WARNING: REPEATED RESETS OF A LOW PRESSURE LOCKOUT COULD CAUSE THE HEAT EXCHANGER TO FREEZE AND RUPTURE, DESTROYING THE HEAT PUMP AND VOIDING THE WARRANTY.

DOMESTIC HOT WATER CONNECTIONS (HACW only)

The port connections for the DHW circuit are 1/2" brass FPT fittings.

A typical piping diagram for a pre-heat tank configuration can be found in **drawing 000970PDG** at the end of this section. Be sure to note the position of the check valve and the direction of water flow. Other configurations are possible, and there may be multiple units tied together in larger buildings.

WARNING: USE ONLY COPPER LINES TO CONNECT THE DESUPERHEATER. TEMPERATURES COULD REACH 200F SHOULD THE DHW CUTOUT SWITCH FAIL, POTENTIALLY RUPTURING PEX PIPING.

Ensure the tank is filled with water and under pressure before activating the heat pump. Slightly loosen the boiler drain on the DHW Out pipe to allow air to escape from the system before the unit is started. This step will make certain that the domestic hot water circulator in the unit is flooded with water when it is started.

CAUTION: the domestic hot water pump is water lubricated; damage will occur to the pump if it is run dry for even a short period of time.

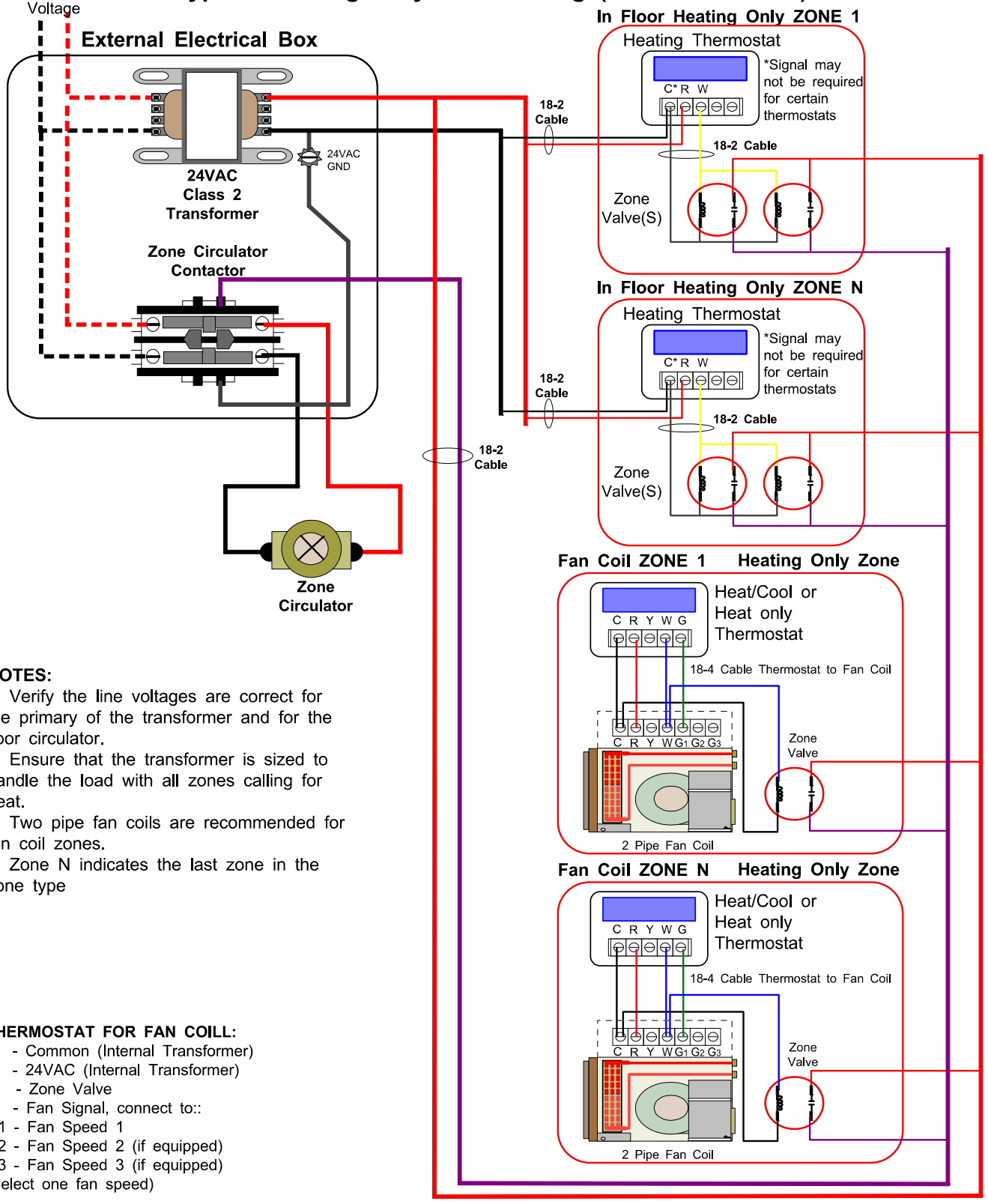
Connect the brown wire with the blue insulated terminal to L1 of the compressor contactor. **Ensure the power is off when connecting the wire.**

The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

For the pre-heat tank setup, the final tank should be set to **140°F(60°C),** unless local code requires a higher setting. The pre-heat tank does not require electric elements. This setup takes full advantage of the desuperheater as it is the sole heat provider to the pre-heat tank. The desuperheater remains active during the compressor runtime until the pre-heat tank has been completely heated by the desuperheater alone. This setup is more energy efficient than a single tank setup.

CAUTION: If two (2) shut-off valves are located on the domestic hot water ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.

Typical Heating Only Zone Wiring (TF&DXTF-Series)


Line Voltage
External Electrical Box
24VAC Class 2 Transformer
24VAC GND
Zone Circulator Contactor
Zone Circulator
18-2 Cable
18-2 Cable
18-2 Cable
In Floor Heating Only ZONE 1
Heating Thermostat
C* R W
*Signal may not be required for certain thermostats
18-2 Cable
Zone Valve(S)
In Floor Heating Only ZONE N
Heating Thermostat
C* R W
*Signal may not be required for certain thermostats
18-2 Cable
Zone Valve(S)
Fan Coil ZONE 1 Heating Only Zone
C R Y W G
Heat/Cool or Heat only Thermostat
18-4 Cable Thermostat to Fan Coil
C R Y W G1 G2 G3
Zone Valve
2 Pipe Fan Coil
Fan Coil ZONE N Heating Only Zone
C R Y W G
Heat/Cool or Heat only Thermostat
18-4 Cable Thermostat to Fan Coil
C R Y W G1 G2 G3
Zone Valve
2 Pipe Fan Coil

NOTES:

1. Verify the line voltages are correct for the primary of the transformer and for the floor circulator.

2. Ensure that the transformer is sized to handle the load with all zones calling for heat.

3. Two pipe fan coils are recommended for fan coil zones.

4. Zone N indicates the last zone in the zone type

THERMOSTAT FOR FAN COILL:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
W - Zone Valve
G - Fan Signal, connect to::
G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	02 JAN 07

Drawn By	Chris Geddes	Date	02 JAN 07
Checked By	Chris Geddes	Date	02 JAN 07
Approved By (ENG)	Chris Geddes	Date	02 JAN 07
Approved By (MFG)		Date	
Approved By		Date	

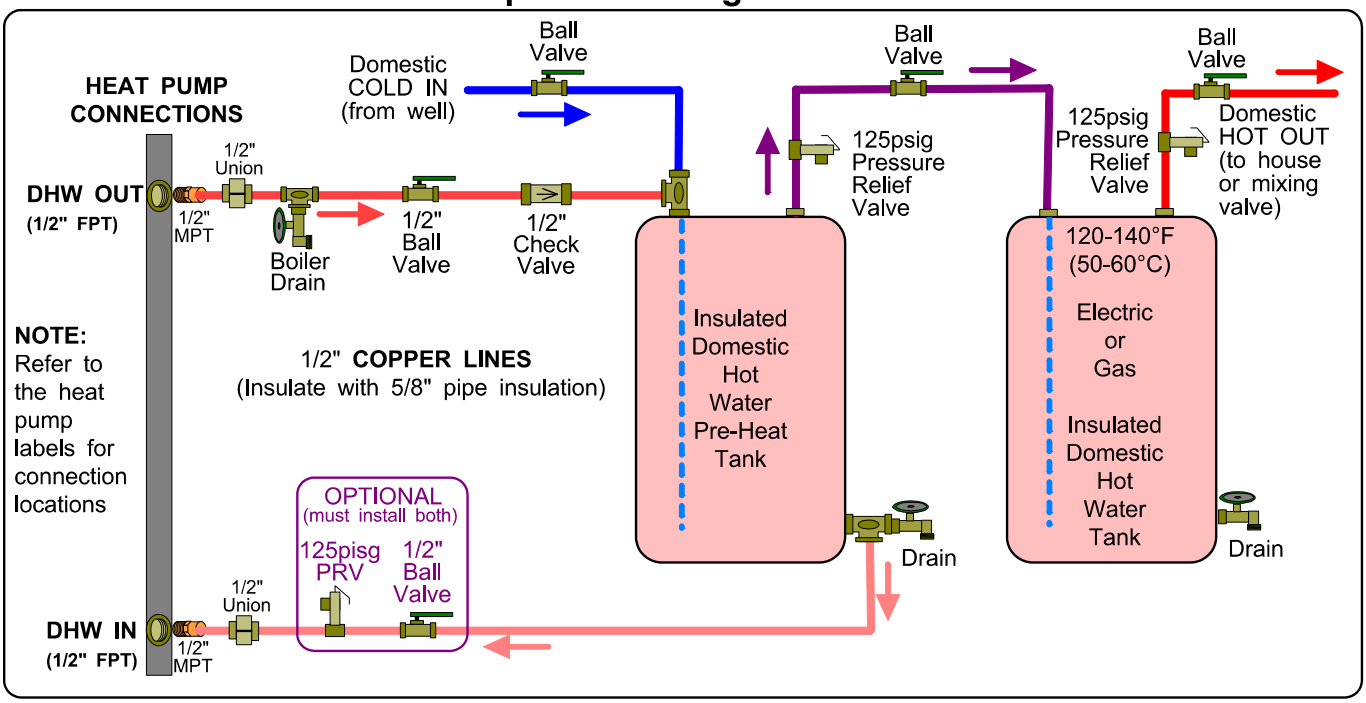
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Heating Only Zone Wring (TF&DXTF-Series)

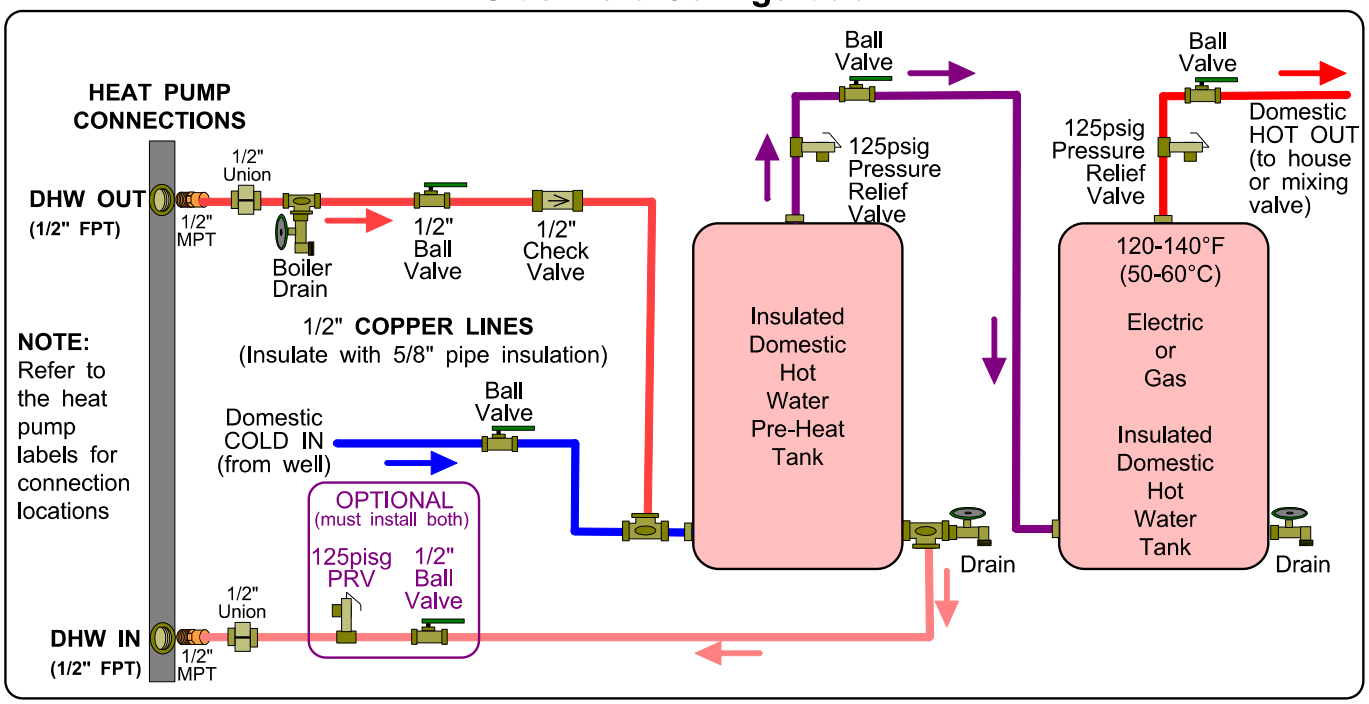
Size	Drawing Number	REV	SHEET
A	000344CDG	01	1 of 1

Single Unit Connection to Domestic Hot Water Pre-Heat Tank (Brass FPT)

Top Port Configuration



Side Port Configuration



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09

Drawn By: Chris Geddes	Date: 10 MAR 09	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Chris Geddes	Date: 10 MAR 09	Drawing Name: Single Unit Connection to DHW Pre-Heat Tank (Brass FPT)	
Approved By (ENG): Chris Geddes	Date: 10 MAR 09		
Approved By (MFG):	Date:		
Approved By:	Date:		

Size	Drawing Number	REV	SHEET
A	000970PDG	01	1 of 1

HEAT PUMP SIZING

TABLE 8 depicts a rough guideline as to the size of home each heat pump size can handle for **ground loop** installations.

TABLE 8 - Heat Pump Size vs. Heated Area for a Ground Loop System

Model	Size (tons)	Sq.ft.	Sq.m.
45	3	1,400	130
55	4	2,000	185
65	5	2,600	240
75	6	3,100	290
80	6	3,500	325

TABLE 9 depicts a rough guideline as to the size a home each heat pump size can handle for **ground water** installations.

TABLE 9 - Heat Pump Size vs. Heated Area for a Ground Water System

Model	Size (tons)	Sq.ft.	Sq.m.
45	3	1,800	165
55	4	2,500	230
65	5	3,200	295
75	6	3,800	355
80	6	4,200	390

THE TABLES ABOVE ARE FOR INFORMATION ONLY, THEY SHOULD NOT BE USED TO SELECT A UNIT SIZE. They simply show on average what size unit is required for a typical two-level home (main level and below grade basement) with R-20 walls, R-40 ceiling and average size and number of windows. The Heated Area is the area of the main level, The tables account for a basement the same size as the heated area.

MARITME GEOTHERMAL LTD. HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMEDE BY A PROFESSIONAL INSTALLER WITH CSA APPROVED SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION. For heating dominant areas, we recommend sizing the unit to 100% of the heating design load for maximum long term efficiency with minimal supplementary heat. The unit should be installed as per CSA 448.2-02. For ground loop applications, the ground exchanger should be designed using suitable software with a multi-year analysis.

There are many factors to consider when sizing the heat pump. Some of these factors include the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, coldest outdoor temperature, etc. The heat loss program will take all of these factors into consideration in its calculations. An undersized installation will not be as efficient as it will require excessive relatively expensive supplemental heat to maintain a comfortable temperature in the home, and the cost savings of having a geothermal heat pump are greatly reduced.

Once the total heat loss has been calculated, the unit can be sized using the performance tables (from the specifications document) in conjunction with the minimum expected entering liquid temperature of the ground loop (well water temperature for ground water system). The heat pump output must be able to match the total heat loss at the selected entering water temperature in order to provide a comfortable environment with minimal auxiliary heat.

DUCT SYSTEMS - GENERAL

Ductwork layout for a heat pump will differ from traditional hot air furnace design in the number of leads and size of main trunks required. Air temperature leaving the heat pump is normally **95º -105ºF (35-40ºC),** much cooler than that of a conventional warm air furnace. To compensate for this, larger volumes of lower temperature air must be moved and consequently duct sizing must be able to accommodate the greater air flow without creating a high static pressure or high velocity at the floor diffusers.

A duct system capable of supplying the required air flow is of utmost importance. Maritime Geothermal Ltd. recommends that the static pressure be kept below 0.2 inches of water total. In some instances the number of floor diffusers will actually double when compared to the number that would be used for a hot air oil-fired furnace. Refer to **TABLE 12** at the end of this section.

1. Generally allow **100 cfm** for each floor grill.
2. All leads to the grills should be 6'' in diameter (28sq.in. each).
3. The main hot air trunks should be at least 75% of the square surface area of leads being fed at any given point.
4. Return air grills should have a minimum of the same total square surface area as the total of the supply grills.
5. The square surface area of the return trunks should equal the square surface area of the grills being handled at any given point along the trunk.

It is ***VERY IMPORTANT*** that all turns in both the supply trunks and the return trunks be made with ***TURNING RADII***. Air act like a fluid and, just like water, pressure drop is increased when air is forced to change direction rapidly around a sharp or irregular corner.

It is recommended that flexible collars be used to connect the main trunks to the heat pump. This helps prevent any vibrations from travelling down the ductwork. If a plenum heater is installed, the collar should be at least 12” away from the heater elements.

The first 5-10 feet of the main supply trunks should be insulated with acoustical duct insulation to further inhibit any noise from the unit from travelling down the ductwork. If a plenum heater is installed, insulation should not be placed within 12” of the heater elements. **Drawing 001201CDG** shows a typical installation.

DUCT SYSTEMS - GRILL LAYOUT

Most forced air heating systems in homes have the floor grills placed around the perimeter of the room to be heated. Supply grills should be placed under a window when possible to help prevent condensation on the window. As mentioned in the previous sub-section, supply grill leads should be 6'' in diameter (28 sq.in. each) to allow **100cfm** of air flow.

In a typical new construction, there should be one supply grill for every 100sq.ft. of area in the room. When rooms require more than one grill, they should be placed in a manner that promotes even heat distribution, such as one at each end of the

room. It is always a good idea to place a damper in each grill supply or place adjustable grills so that any imbalances in the heat distribution can be corrected.

The total number of supply grills available is based on the heat pump nominal airflow. **TABLE 10** shows the number of grills available per heat pump size.

TABLE 10 - Heat Pump Size vs. Hot Air Grills

Model	Size (tons)	# of Grills (@100cfm)
45	3	12
55	4	15
65	5	19
75	6	21
80	6	24

Return grills should be mounted on the floor. At minimum they should be the same size as the supply grill, **it is highly recommended that they be 25% to 50% larger than the total supply.** They should be placed opposite the supply grills when possible to ensure distribution across the room. For rooms requiring more than one supply grill, it may be possible to use one larger return grill if it can be centrally positioned opposite of the supply grills, however it is preferred to have one return for each supply to maximize heat distribution across the room.

THERMOSTAT LOCATION

Most homes are a single zone with one thermostat. The thermostat should be centrally located within the home, typically on the main floor. It should be placed away from any supply grills, and should not be positioned directly above a return grill. Most installations have the thermostat located in a hallway, or in the inner wall of the living room. It should be noted that most homes do not have any supply ducts in the hallway. This can lead to a temperature lag at the thermostat if there is very little air movement in the hallway, causing the home to be warmer than indicated by the thermostat.

PLENUM HEATER (OPTIONAL)

For installations that do not already have a backup heat source such as electric baseboard, wood stove, propane etc, it is recommended that a plenum heater be installed. This provides two functions.

The first function of the plenum heater is to act as an auxiliary heat source. As such it will provide additional heat on extremely cold days if the heat pump is unable to bring the home temperature up quickly enough, eliminating any discomfort to the homeowner.

The second function of the plenum heater is to provide emergency heat should a problem occur that causes the heat pump to be locked out. This can be engaged by setting the thermostat to emergency heat, allowing the plenum heater to function while preventing the heat pump from operating. Should the heat pump fail while the home is vacant, the auxiliary function of the thermostat will maintain the temperature setting of the thermostat.

INSTALLATION—Fan outlet at top of unit: The heat pump comes equipped with an internal mounting location for the plenum heater. Remove the screws from the cover plate, remove the cover plate and place the plenum heater in the hole. Secure it in place with the cover plate screws. Use the indicated knockouts on the heat pump case for electrical connections.

When installation is complete, check the appropriate box of the label on the air handler door to indicate which size heater was installed.

INSTALLATION—Fan outlet at side of unit: The plenum heater should be installed in the supply duct in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements. Ensure that the plenum heater is mounted in an approved position as per its instructions.

Only two control wires are needed to connect the plenum heater to the **heat pump terminal strip.** Refer to the label on the plenum heater or the electrical box diagram on the inside of the electrical box cover of the **compressor unit** for details on the connections.

The plenum heater requires its own separate power supply. **TABLE 11** shows the recommended size plenum heater, as well as the wire size and breaker size needed to provide power to the plenum heater. Refer to the Electrical Tables for electrical connection information.

TABLE 11 - Plenum Heater Sizing

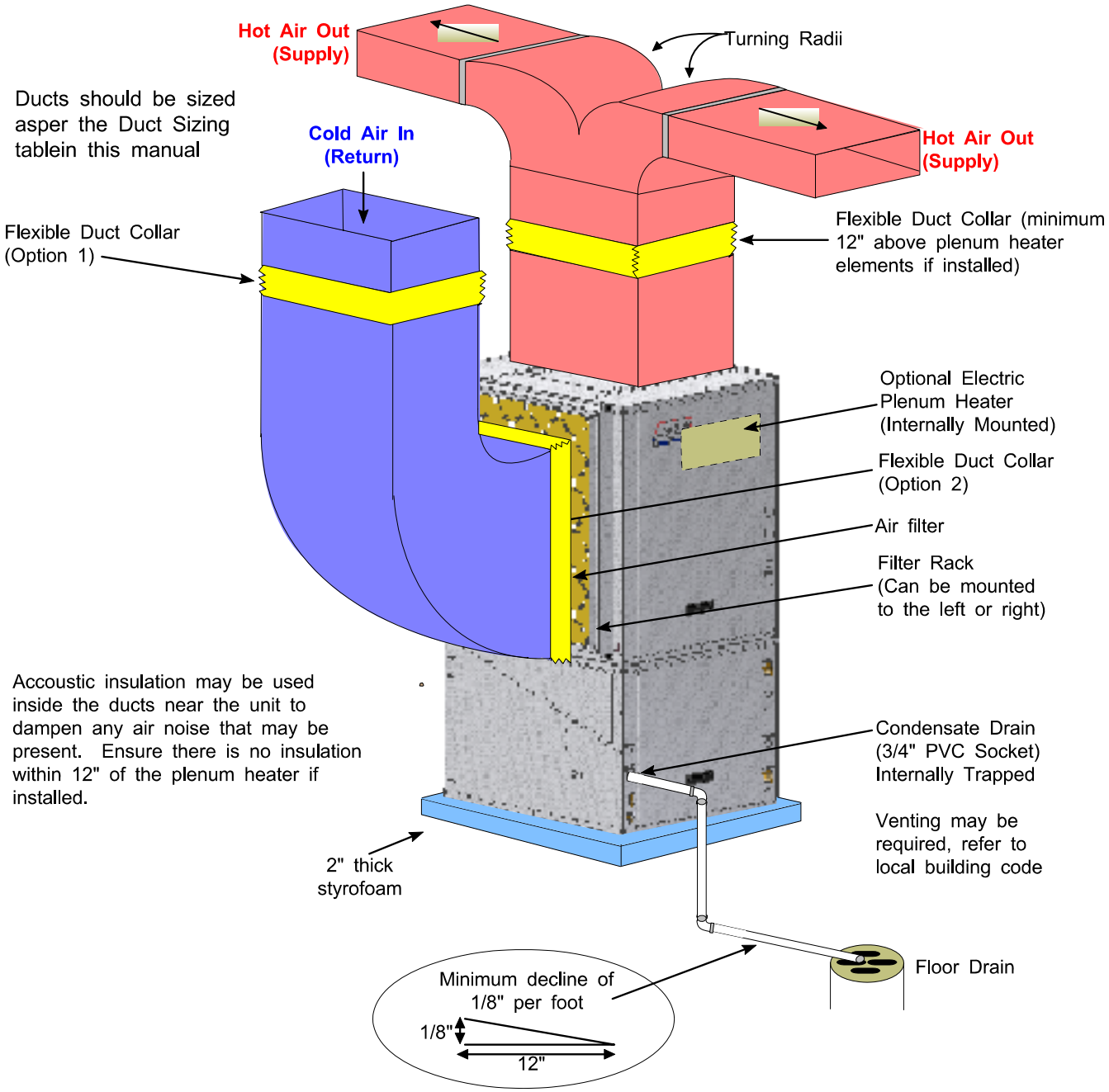
Heat Pump Model Size	Plenum Heater Sizes (kW)		
	Recommended	Available	
45	10	7	
55	10	7	15
65	15	10	20
75 - 80	20	15	

CONDENSATE DRAIN

The unit comes equipped with a 3/4" PVC socket fitting (female) labeled "Condensate Drain". This drain allows the condensate which forms during the air-conditioning cycle to be removed from the unit. The drain should be connected as per local codes. During high humidity weather, there could be as much as 25 gallons of water formed per day.

Care should be taken in the spring to ensure that this pipe is not plugged with dust that has collected during the winter causing the condensate to overflow into the bottom of the heat pump and onto the floor. **The condensate drain is internally trapped; however, proper venting is required external to the heat pump. Refer to local codes to ensure the installation is done properly.** **Drawing 001201CDG** shows a typical installation.

Typical Duct and Condensate Connections (Modular Case)


Hot Air Out
(Supply)
Turning Radii
Ducts should be sized asper the Duct Sizing tablein this manual
Cold Air In
(Return)
Hot Air Out
(Supply)
Flexible Duct Collar
(Option 1)
Flexible Duct Collar (minimum 12" above plenum heater elements if installed)
Optional Electric Plenum Heater (Internally Mounted)
Flexible Duct Collar (Option 2)
Air filter
Filter Rack (Can be mounted to the left or right)
Accoustic insulation may be used inside the ducts near the unit to dampen any air noise that may be present. Ensure there is no insulation within 12" of the plenum heater if installed.
Condensate Drain (3/4" PVC Socket) Internally Trapped
Venting may be required, refer to local building code
2" thick styrofoam
Floor Drain
Minimum decline of 1/8" per foot
1/8"
12"

					Drawn By Chris Geddes	Date 22 JAN 09	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4	
					Checked By Chris Geddes	Date 22 JAN 09	Drawing Name	Typical Duct and Condensate Connections (Modular Case)	
					Approved By (ENG) Chris Geddes	Date 22 JAN 09			
01	Initial Release	C. GEDDES	C. GEDDES	22 JAN 09	Approved By (MFG)	Date	Size A	Drawing Number 001201CDG	REV 01 / SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date			

TABLE 12 - Duct Sizing Guide (external static of 0.20”H2O)

Airflow (CFM)	Minimum Duct Area (sq.in)	Diameter (in)	Rectangular Equivalents (in)						Return Air Diameter (in)	Airflow (L/s)
37	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5		5	17
63	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5		6	30
100	28	6	3.25 x 10	4 x 8	5 x 6	5.5 x 5.5	6 x 6		7	47
152	38	7	3.25 x 14	4 x 11	5 x 8.5	6 x 7	6.5 x 6.5		8	72
212	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		9	100
226	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		10	107
277	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		10	131
304	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		12	143
393	79	10	6 x 15	7 x 13	8 x 11	9 x 10	9.5 x 9.5		12	185
411	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		12	194
655	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		14	309
680	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	14	321
995	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	16	470
1325	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		18	625
1450	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		20	684
1750	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	20	826
2000	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	22	944
2250	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	22	1062
2600	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	24	1227
2900	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		24	1369
3400	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		26	1605
3600	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		26	1699
4300	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		28	2029
5250	531	26	16 x 38	18 x 32	20 x 30	22 x 24	24 x 24		30	2478
6125	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		32	2891
6500	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		34	3068
7250	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		34	3422
7800	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		36	3681
8500	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		36	4012
9200	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		38	4342
9800	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	38	4625
10900	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	40	5144
			28 x 40	30 x 36	32 x 34	33 x 33				
			30 x 42	32 x 38	34 x 36	35 x 35				
			30 x 45	34 x 40	36 x 38	37 x 37				

HYDRONIC SYSTEMS - GENERAL

The most common applications for the TF-Series hydronic heating are: (see **drawing 000530PDG** for typical zone types)

- radiant in-floor heating
- On-demand domestic hot water
- Swimming pool or spa

The radiant in-floor areas of the home may be sectioned into several areas called zones. Each zone has its own thermostat, allowing simple separate temperature control of the individual areas in the home. A typical system consists of the heat pump, the buffer tank and the zones. The sole purpose of the heat pump is to maintain the buffer tank set point. Its operation is independent of the zone operation.

HYDRONIC SYSTEM CONNECTIONS

The port connections for the Indoor Loop are 1" brass FPT fittings They are marked as INDOOR IN and OUT.

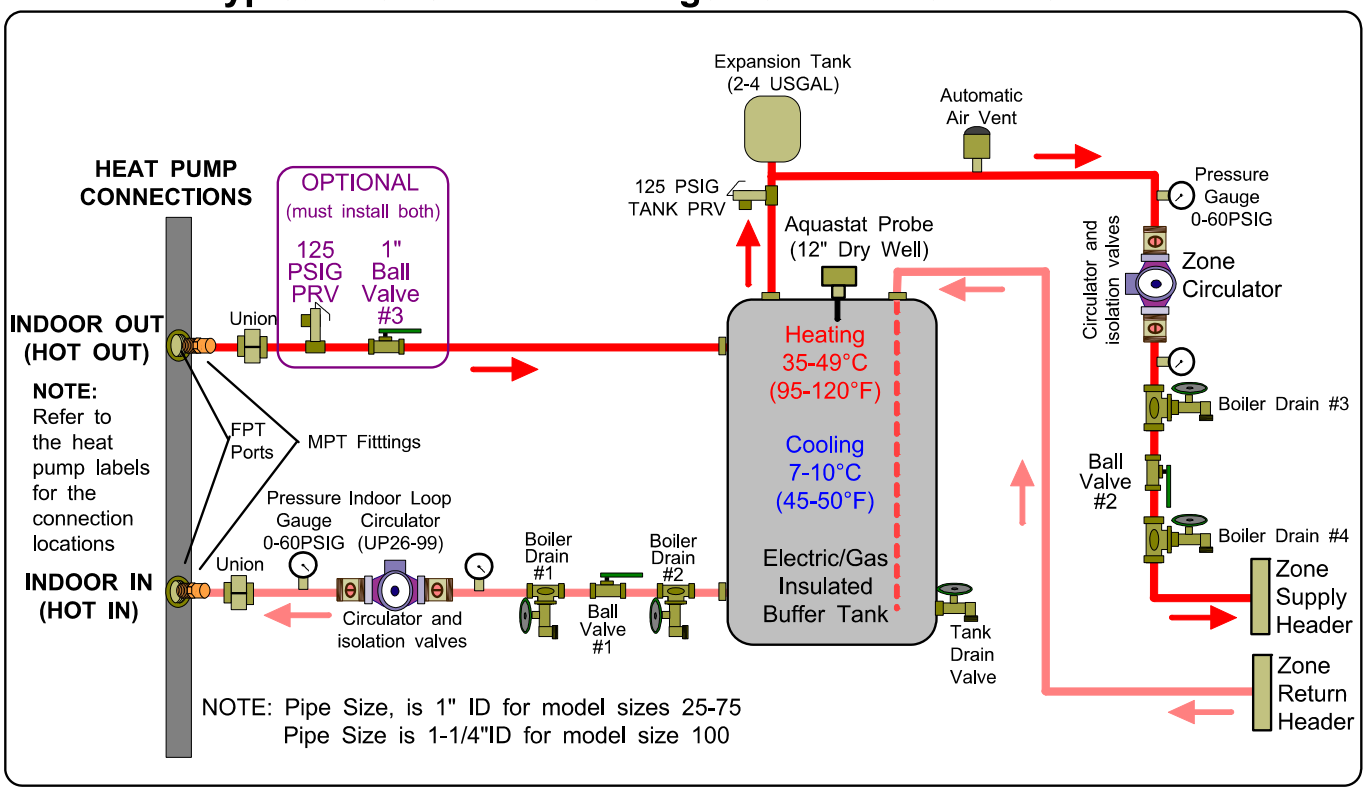
Flow through the unit is provided by an external circulator connected to the Indoor Loop Circulator terminal strip in the electrical box of the unit. The circulator is only powered when in hydronic heating mode and the compressor is operating.

Drawing 001046PDG shows a typical piping configuration for a single unit with a buffer tank. This is a guideline for a simple installation. This is a typical installation where there may be one or several floor zones or even fan coils. There are many other configurations, such as, multiple units connected to one buffer tank, on-demand domestic only, etc… It is recommended that the hydronic system be designed by a qualified system designer to ensure proper functionality.

Drawing 001055PDG shows two typical on-demand domestic hot water systems, dedicated and zoned. For a dedicated set-up, there are no zones and the home is heated solely by air. The TF unit can very easily be switched between air or hydronic priority during installation simply by placing or removing a jumper between the set of PR pins on the aquastat terminal strip. Jumper in place sets the unit to air priority.

WARNING: Most indirect tank heat transfer ratings are done at high water temperatures such as 160°F (71°C). Be sure to select an indirect tank that has a transfer rate of at least the heat pump capacity at open loop conditions (refer to TABLE 20). Failure to do so can lead to nuisance high pressure trips due to inadequate heat transfer from the heat pump to the tank.

Typical Buffer Tank Configuration - Four Port Tank



NOTES:

1. Refer to diagram 000530PDG for the typical types of zones that may be connected to the supply and return headers.
2. Unions or another type of disconnect should be used to connect the heat pump to the loop.
3. Circulators should be mounted vertically when possible to reduce the chance of air getting caught in the housing.
4. The automatic air vent must be installed upright to function properly.
5. If the optional 1" ball valve is installed in the Indoor Out line, **the PRV must be installed as well,** to prevent pressure build up should both ball valves be closed.
6. Pressure gauges (0-60PSIG) are placed on both sides of the circulators for a quick check method to determine that the circulators are pumping.
7. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
8. The aquastat probe should be placed all the way in the dry well, and the end of the well where the probe wire is should be well insulated.
9. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (ie methanol), and there are electric elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion.**

PURGING PROCEDURE:

1. Ensure the power to the heat pump and any other power supplies connected to the system (floor circulator, etc) are turned off.
2. The system can be filled using Boiler Drain #1.. Connect the fill hose to the boiler drain and begin filling. Open the tank PRV to purge the air out as the system fills. Close the tank PRV when water begins to run out of it.
3. Open the automatic air vent.
4. Connect the purge hose to Boiler Drain #2. Close Ball Valve #1. Open Ball Valve #3 if installed. Open Boiler Drain #2. Purge until air is no longer heard leaving the system. Open the Tank PRV and let any air out. Close Boiler Drain#1, #2 and Ball Valve #1 and #3 if installed.
5. Zone can be purged by moving the fill hose (turn it off first) from Boiler Drain #1 to Boiler Drain #4. Connect the purge hose to Boiler Drain #3. Close Ball Valve #2. Open Boiler Drains #3 and #4. Purge each zone individually and then open them all at once. Zones can be opened using the individual thermostats or most can be opened manually. Open the Tank PRV intermittently to purge any air during this process.
6. When purging is complete, pressurize the system between 15 and 25PSIG.
7. Turn the fill hose off. Close Boiler Drains #3 and #4. Open Ball Valve #2. Remove the fill (turn the hose off first) and purge hoses.
8. Repeat steps 4 to 6 as necessary if air is still present in the system.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09

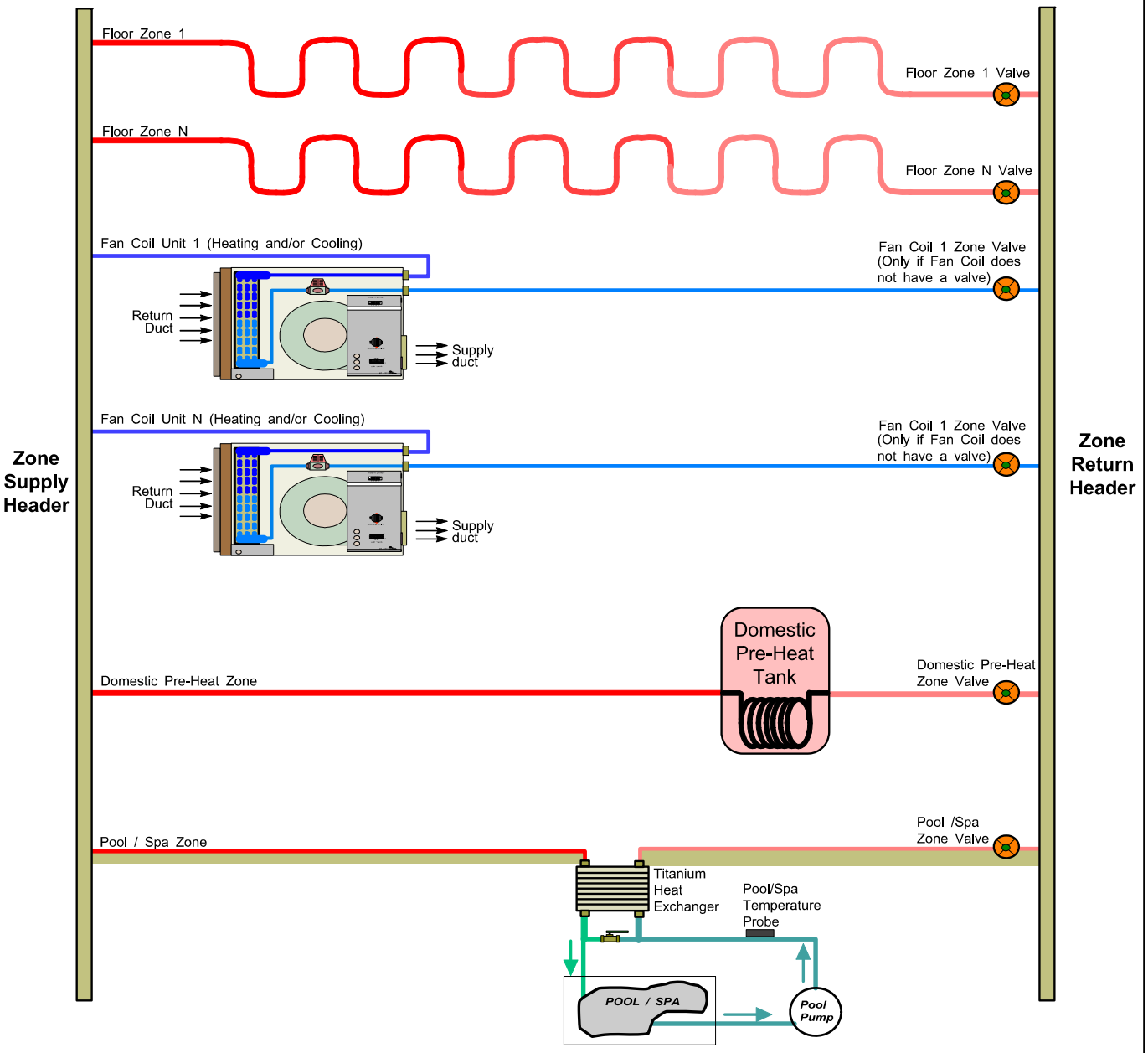
Drawn By: Chris Geddes	Date: 10 MAR 09	
Checked By: Chris Geddes	Date: 10 MAR 09	
Approved By (ENG): Chris Geddes	Date: 10 MAR 09	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name: Typical Buffer Tank Configuration - Four Port Tank (Brass FPT)

Size	Drawing Number	REV	SHEET
A	001046PDG	01	1 of 1

Typical Zone Types for Hydronic Applications


Floor Zone 1
Floor Zone 1 Valve
Floor Zone N
Floor Zone N Valve
Fan Coil Unit 1 (Heating and/or Cooling)
Fan Coil 1 Zone Valve (Only if Fan Coil does not have a valve)
Return Duct
Supply duct
Fan Coil Unit N (Heating and/or Cooling)
Fan Coil 1 Zone Valve (Only if Fan Coil does not have a valve)
Return Duct
Supply duct
Zone Supply Header
Zone Return Header
Domestic Pre-Heat Tank
Domestic Pre-Heat Zone
Domestic Pre-Heat Zone Valve
Pool / Spa Zone
Pool /Spa Zone Valve
Titanium Heat Exchanger
Pool/Spa Temperature Probe
POOL / SPA
Pool Pump

NOTES:

1. Floor zones are heating only. Cooling a floor zone will cause condensation in the floor. Floor zone valves should be wired through a relay that is controlled by the cooling signal (O) that breaks the signal when in cooling mode to ensure that they cannot accidentally be energized.
2. There may be multiple floor zones.
3. There may be multiple fan coil units, (heating and /or cooling). A zone valve is not required if the unit has a internal valve.
4. Domestic Pre-Heat Tank is for on-demand apllications. The tank must have a heat eaxchanger in it or an external one must be used to separate the zone loop from the potable water supply.
5. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
6. The pool aquastat will operate the Pool/Spa Zone Valve.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	06 SEP 07

Drawn By: Chris Geddes	Date: 06 SEP 07	
Checked By: Chris Geddes	Date: 06 SEP 07	
Approved By (ENG): Chris Geddes	Date: 06 SEP 07	
Approved By (MFG):	Date:	
Approved By:	Date:	

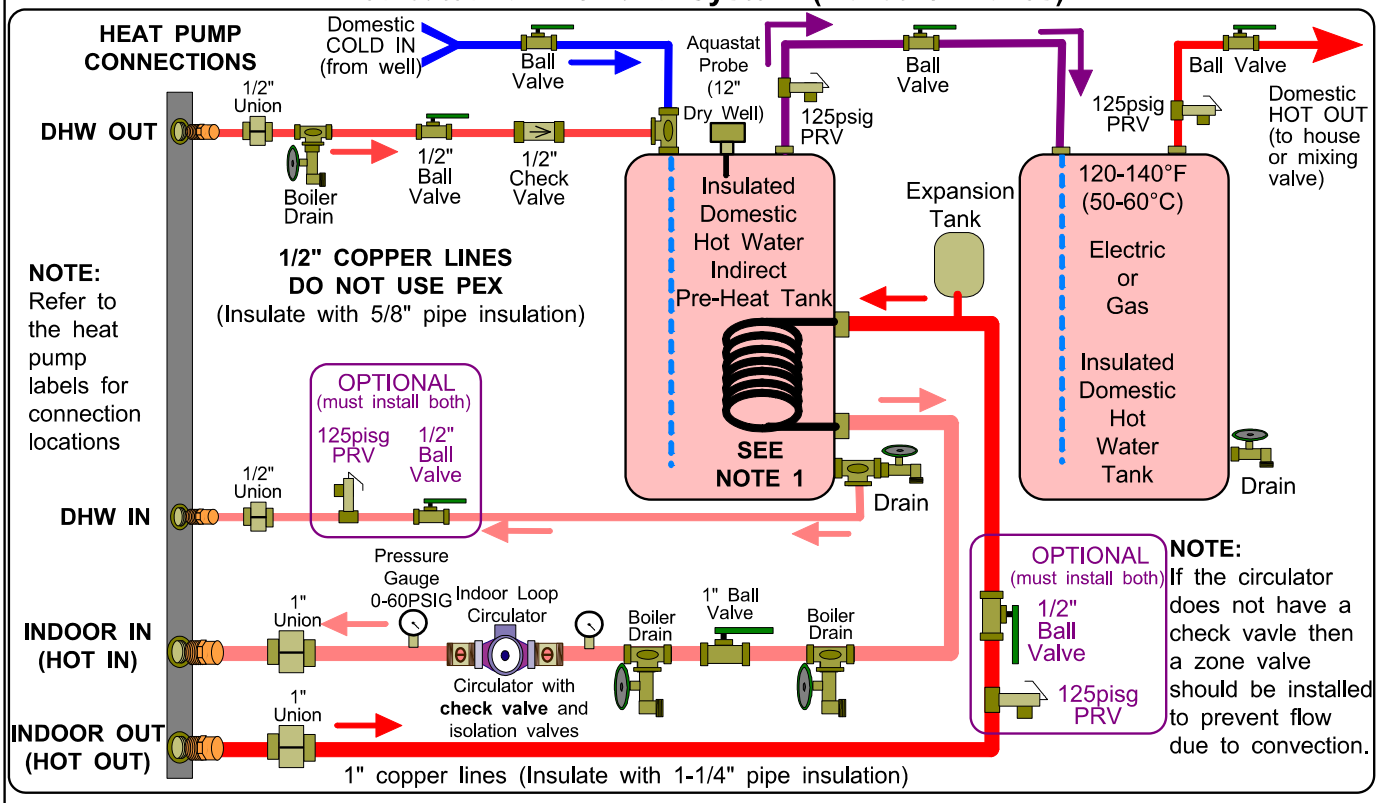
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Zone Types for Hydronic Applications

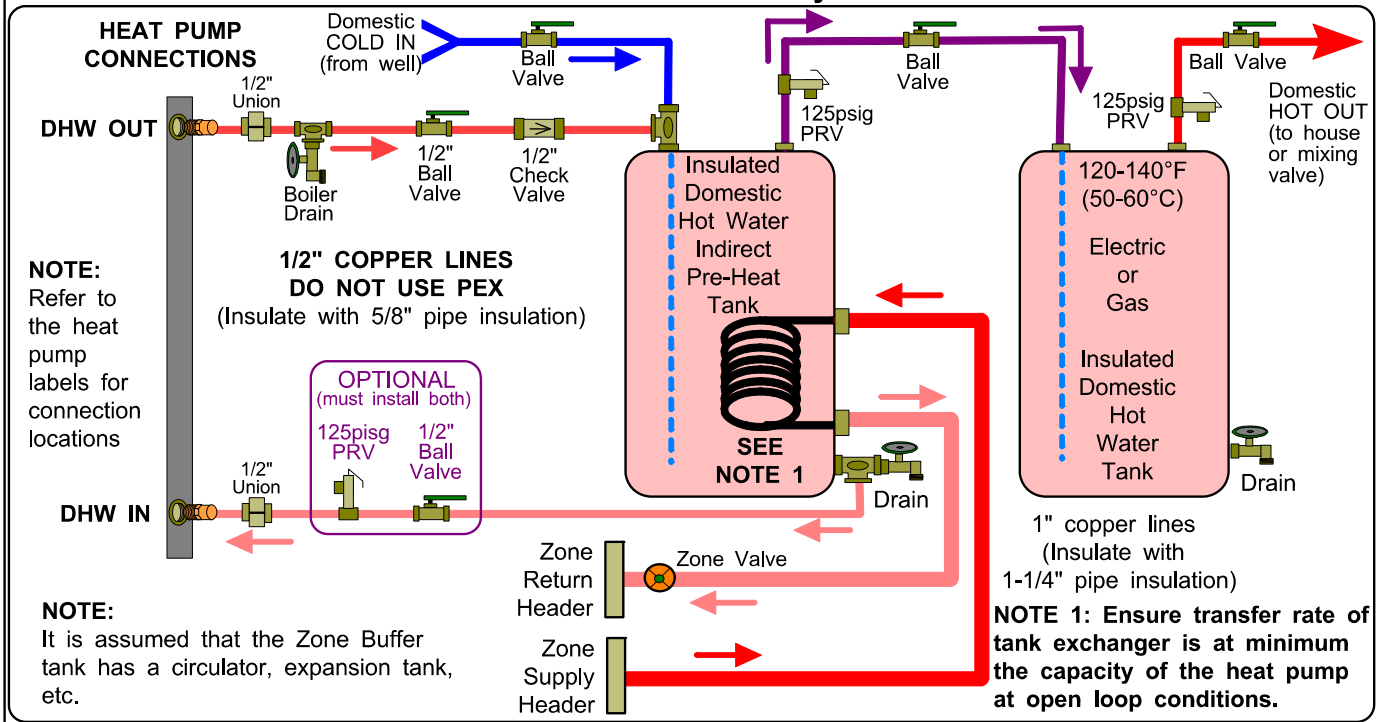
Size	Drawing Number	REV	SHEET
A	000530PDG	01	1 of 1

Single Unit Connection to On-Demand Domestic Hot Water Pre-Heat Tank

Dedicated On-Demand System (No other zones)



Zoned On-Demand System


HEAT PUMP CONNECTIONS
Domestic COLD IN (from well)
Ball Valve
Ball Valve
125psig PRV
Ball Valve
125psig PRV
Domestic HOT OUT (to house or mixing valve)
DHW OUT
1/2" Union
Boiler Drain
1/2" Ball Valve
1/2" Check Valve
Insulated Domestic Hot Water Indirect Pre-Heat Tank
120-140°F (50-60°C)
Electric or Gas
Insulated Domestic Hot Water Tank
NOTE: Refer to the heat pump labels for connection locations
1/2" COPPER LINES DO NOT USE PEX
(Insulate with 5/8" pipe insulation)
OPTIONAL (must install both)
125pisg PRV
1/2" Ball Valve
1/2" Union
DHW IN
SEE NOTE 1
Drain
Drain
Zone Return Header
Zone Valve
Zone Supply Header
1" copper lines (Insulate with 1-1/4" pipe insulation)
NOTE: It is assumed that the Zone Buffer tank has a circulator, expansion tank, etc.
NOTE 1: Ensure transfer rate of tank exchanger is at minimum the capacity of the heat pump at open loop conditions.

REV	ECO #	IMPL BY	APVD BY	DATE
02	000161	C. GEDDES	C. GEDDES	05 FEB 10
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 09

Drawn By: Chris Geddes	Date: 29 JUN 09	
Checked By: Chris Geddes	Date: 29 JUN 09	
Approved By (ENG): Chris Geddes	Date: 29 JUN 00	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name: Single Unit Connection toOn-Demand DHW Pre-Heat Tank (Brass FPT)

Size	Drawing Number	REV	SHEET
A	001055PDG	02	1 of 1

Ground Water System Information

GENERAL REQUIREMENTS

1. The temperature of the well water should be a minimum of **39°F (4°C),** and should normally be **45+°F (7°C)**
2. The well system must be able to supply the required water flow as listed under the Total Flow column in **TABLE 13**.

TABLE 13 - Required Flow and Air Tank Sizing

Heat Pump Model Size	Heat Pump Flow* IGPM (USGPM)	Home Flow IGPM (USGPM)	Total Flow IGPM (USGPM)	Minimum Air Bladder Tank** IGal (USgal)
45	8 (9.6)	3 (3.6)	11(13.2)	22(26)
55	10 (12.0)	3 (3.6)	13(15.6)	26(31)
65	12 (14.4)	3 (3.6)	15(18.0)	30(36)
75 - 80	14 (16.8)	3 (3.6)	17(20.4)	34(41)

* These are minimum water requirements based on an entering water temperature of 46° F.

**Based on two-minute well pump run time. Use next size larger tank if there is not a match for the value indicated. A larger tank may be used if a longer run time is desired.

PLUMBING THE HEAT PUMP

The port connections for the Outdoor Loop are 1" brass FPT fittings. They are marked as OUTDOOR IN and OUT.

Plumbing lines, both supply and discharge, must be of adequate size to handle the water flow necessary for the heat pump. A 1" copper or plastic line should be run to the Outdoor IN (Supply IN) pipe of the heat pump. Similarly, a 1"' line should be run from the Outdoor OUT (Supply Out) pipe to the method of disposal. P/T plugs should be installed at each port. See **Diagram A** in the Ground Loop section for a description of P/T plugs. The water valve should be installed in the discharge line. **Refer to drawing *000907CDG* at the end of this section** for the recommended setup. Placing the water valve in the discharge line ensures that the heat exchanger inside the heat pump remains full of water when the unit is not running. Unions or some other form of disconnect should be used so that the coaxial heat exchanger may be accessed should it required cleaning.

The heat pump has an electrical connector for the water valve just inside the case. After the water valve is installed, run the valve harness into the case through the hole provided. Remove the jumper plug from the Valve Connector and connect the harness in its place.

Ideally there will be water flow available in excess of the requirement of the heat pump. In such a situation the proper pump can be selected to maintain a pressure of 30 to 40 psig. on the lines when the heat pump is operating. However in some cases a well can supply a heat pump only if the minimum requirement for water is used.

Water flow to the heat pump can be controlled very accurately by the installation of a reverse action refrigeration pressure valve in the discharge line of the unit.

Another more common method of regulating the flow is by the use of a **DOLE** Valve. This valve will automatically control the amount of water flowing through it by varying the diameter of a flexible rubber orifice through which the water passes. This minimizes the water usage of the unit and also prevents excessively low discharge pressure when in cooling mode. Dole valves can be noisy, it is recommended that they be installed outside if possible.

Optionally a water flow meter can be installed in the discharge line so that the exact amount of water flowing can be determined at a glance. It should be placed between the Outdoor OUT (Supply OUT) pipe of the heat pump and the water valve.

With Proper flow, there should be **5-7°F (3-4°C)** delta T between the IN and OUT water temperatures of the heat pump when operating in the heating mode.

All water line valves on both the supply and discharge lines should be either BALL or GATE valves. GLOBE valves have a higher pressure drop, meaning more pumping power to maintain the required flow to the heat pump.

PIPE INSULATION

All ground water piping to and from the Outdoor Loop ports on the heat pump should be insulated with 3/8" closed cell pipe insulation, to prevent condensation and dripping onto floors or walls.

WATER DISCHARGE METHODS

Water disposal methods vary from area to area. However, some consideration should be made to prevent the cooled discharge water from immediately coming in contact with the supply source. Attempting to return the water to the source well will eventually cool the water so much that the heat pump will shut off on its low pressure safety control.

Acceptable methods for disposing of the waste water are listed below. The waste water is clean, the heat pump has no effect other than reducing the temperature of the water. **Refer to the Ground Water Disposal methods diagram** for typical disposal method diagrams.

- Second well (return well)
- Percolation (Drain, ditch, leaching field)
- Pond, river or stream.

ENSURE SELECTED METHOD CONFORMS TO LOCAL CODES.

A return well should be a minimum of **80 ft.** from the supply well for residential applications. The water returned to the well will not necessarily be pumped into the same aquifer, depending on underground conditions. The return well must be able to supply at least the same quantity of water as the amount you wish to recharge into it. If the static level (level when not being pumped) of a well is high (10 to 20 ft. from the surface) it may be necessary to place a well cap on the well to keep the return water from flowing out the top of the well. This cap is commonly required since a certain amount of pressure is needed to force the return water back down the well if the static level is high.

Water discharged by percolation will generally soak into the ground within a distance of 50 to 100 ft. If suitable care is taken to ensure that the drain pipe runs downhill and the end of the pipe is protected by a bale of hay or spruce bows etc. the end of the pipe will not freeze as the pipe will empty out when the heat pump shuts off and the water valve closes.

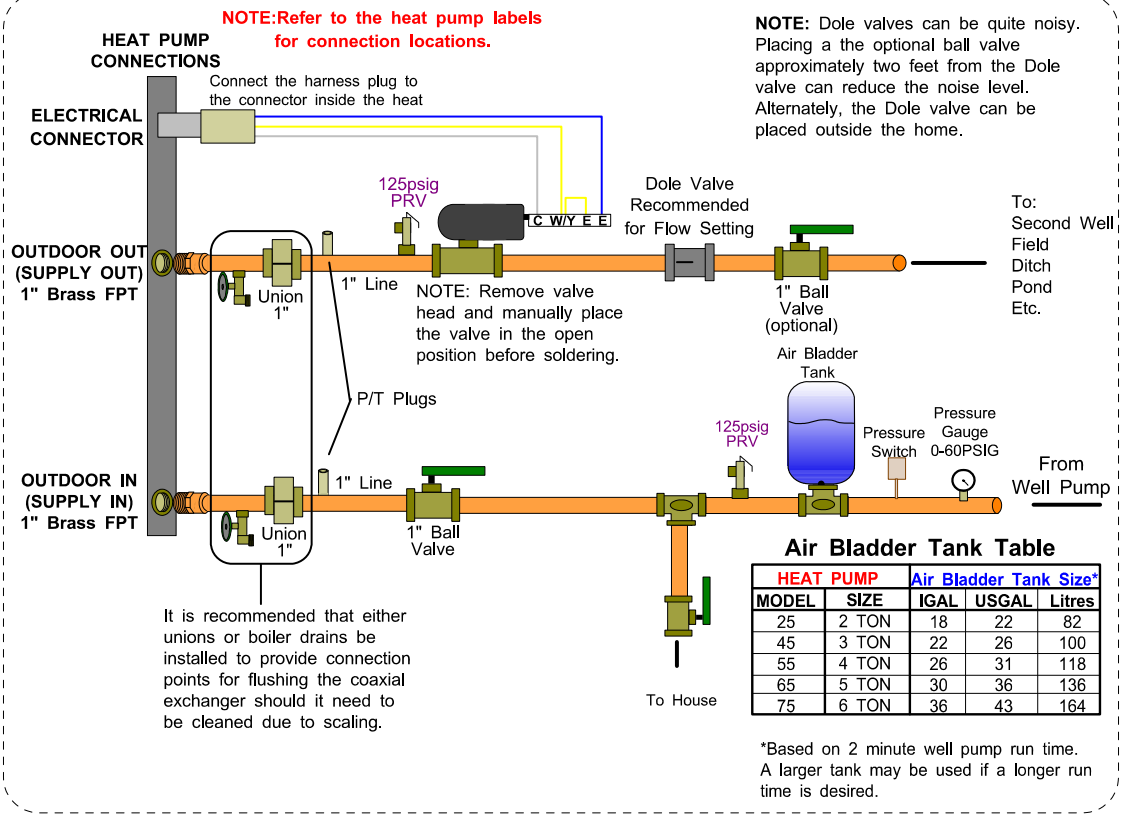
When snow comes it will usually cover the entire process much like a small spring. It is recommended that the pipe be below the frost line when possible for maximum freeze protection.

When discharging into a river or stream, or above the surface of a pond, the same guidelines should be followed as described in the paragraph above for the percolation method.

When discharging the waste water below the surface of a pond, the discharge pipe should be placed below the frost line to prevent the pipe from freezing. As opposed to the percolation method, water will remain in the end of the pipe. It is recommended that the surface of the pond be lower than the installation location of the heat pump where practical. This reduces the back pressure generated by the weight of the water in the pond.

Typical Ground Water Installation for Size 25-75 Heat Pumps for Units With Brass FPT Fittings

TACO 24VAC EBV (Electronic Ball Valve)

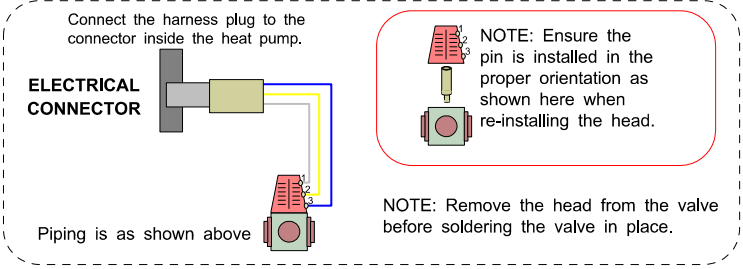

NOTE:Refer to the heat pump labels for connection locations.
HEAT PUMP CONNECTIONS
Connect the harness plug to the connector inside the heat
ELECTRICAL CONNECTOR
125psig PRV
C W/Y E E
Dole Valve Recommended for Flow Setting
NOTE: Dole valves can be quite noisy. Placing a the optional ball valve approximately two feet from the Dole valve can reduce the noise level. Alternately, the Dole valve can be placed outside the home.
To: Second Well Field Ditch Pond Etc.
OUTDOOR OUT (SUPPLY OUT) 1" Brass FPT
Union 1"
1" Line
NOTE: Remove valve head and manually place the valve in the open position before soldering.
1" Ball Valve (optional)
Air Bladder Tank
P/T Plugs
125psig PRV
Pressure Switch
Pressure Gauge 0-60PSIG
From Well Pump
OUTDOOR IN (SUPPLY IN) 1" Brass FPT
Union 1"
1" Line
1" Ball Valve
It is recommended that either unions or boiler drains be installed to provide connection points for flushing the coaxial exchanger should it need to be cleaned due to scaling.
To House

Air Bladder Tank Table

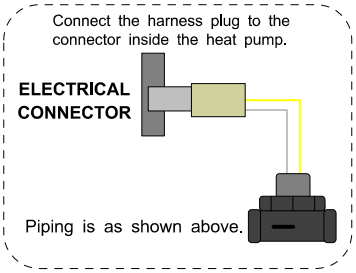
HEAT PUMP		Air Bladder Tank Size*		
MODEL	SIZE	IGAL	USGAL	Litres
25	2 TON	18	22	82
45	3 TON	22	26	100
55	4 TON	26	31	118
65	5 TON	30	36	136
75	6 TON	36	43	164

*Based on 2 minute well pump run time. A larger tank may be used if a longer run time is desired.

TACO 24VAC Slow Close Water Valve


Connect the harness plug to the connector inside the heat pump.
ELECTRICAL CONNECTOR
Piping is as shown above
NOTE: Ensure the pin is installed in the proper orientation as shown here when re-installing the head.
NOTE: Remove the head from the valve before soldering the valve in place.

Generic 24VAC Solenoid Water Valve



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	10 DEC 08

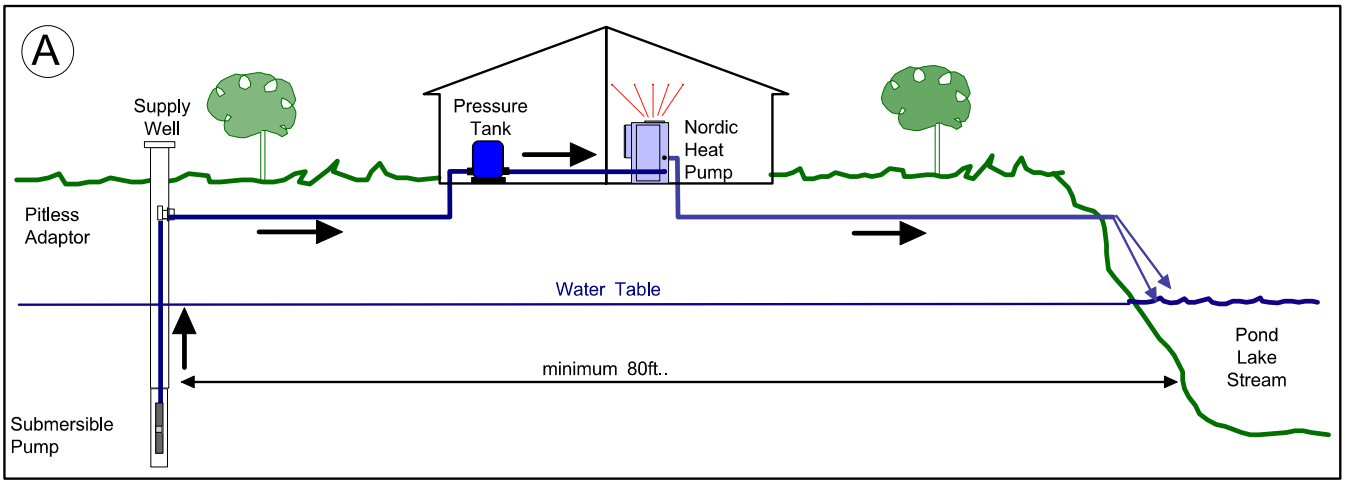
Drawn By	Chris Geddes	Date 10 DEC 08
Checked By	Chris Geddes	Date 10 DEC 08
Approved By (ENG)	Chris Geddes	Date 10 DEC 08
Approved By (MFG)		Date
Approved By		Date

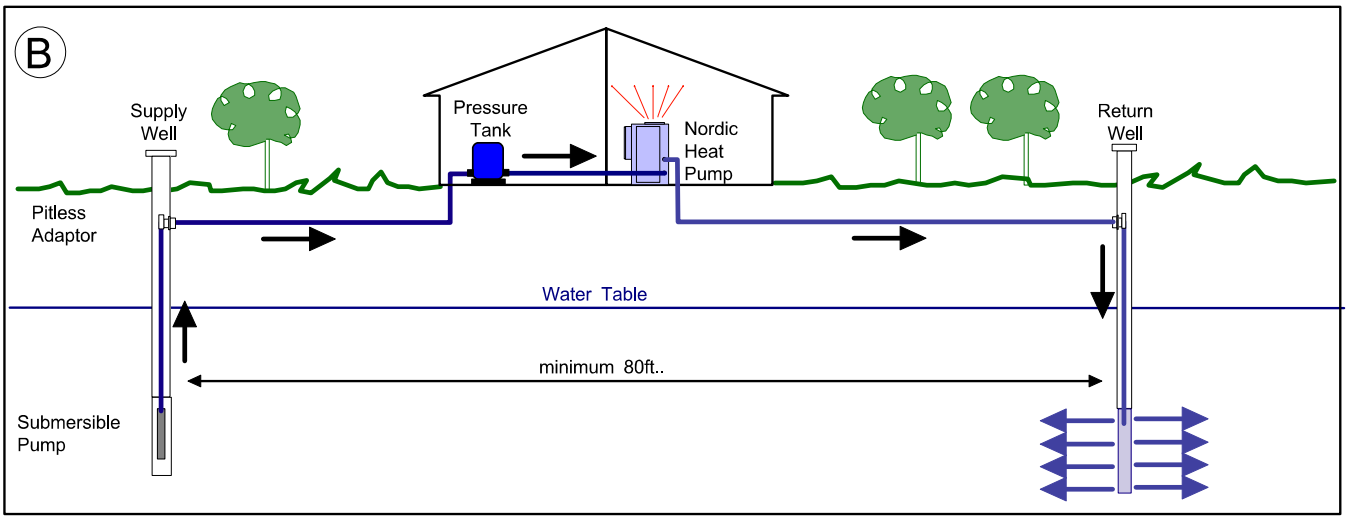
MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

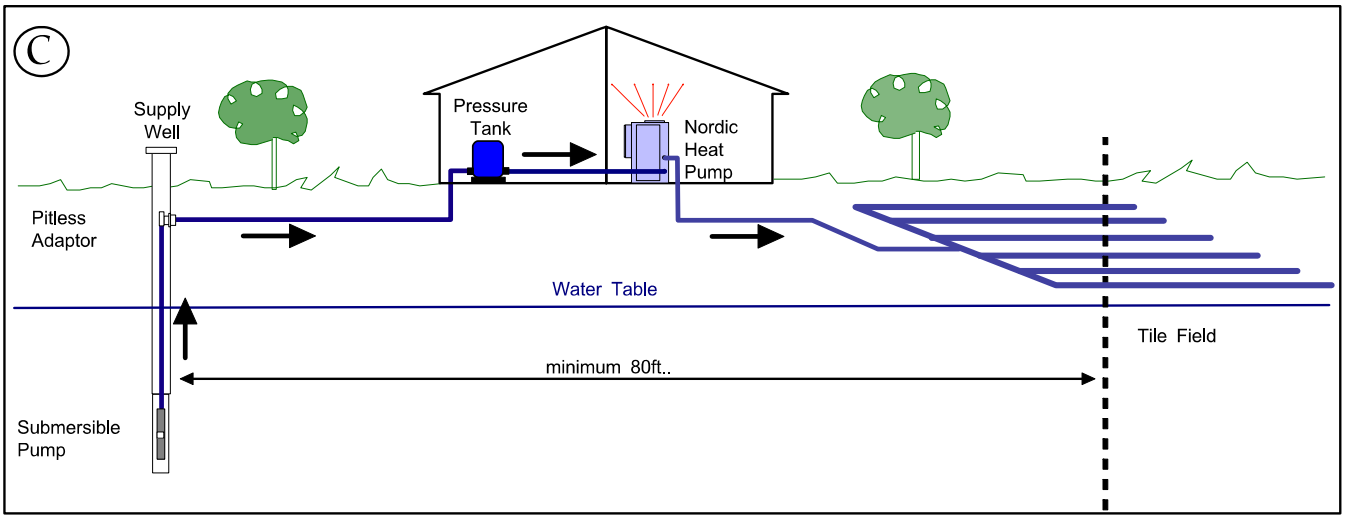
Drawing Name: Typical Ground Water Installation for Size 25-75 Heat Pumps (Brass FPT)

Size	Drawing Number	REV	SHEET
A	000907CDG	01	1 of 1

GROUND WATER DISPOSAL METHODS







01	Initial Release	C. GEDDES	C. GEDDES	04 FEB 08
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By	Chris Geddes	Date	04 FEB 08
Checked By	Chris Geddes	Date	04 JAN 08
Approved By (ENG)	Chris Geddes	Date	04 FEB 08
Approved By (MFG)		Date	
Approved By		Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Ground Water Disposal Methods

Size	Drawing Number	REV	SHEET
A	000619INF	01	1 of 1

Once the ground loop has been pressure tested and the header pipes have been connected to the circulator pump module, the heat pump can be connected to the circulator pump module.

CIRCULATOR PUMP MODULE

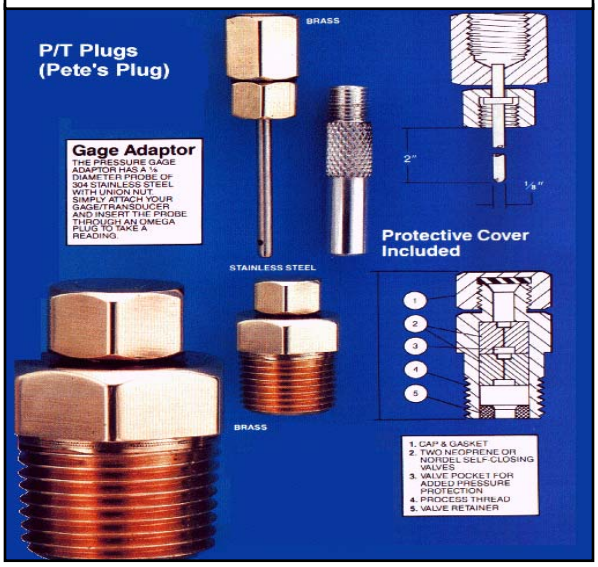
Maritime Geothermal Ltd. has compact pump modules with built in three way valves to facilitate filling and purging the ground loop. **Refer to drawing 000906CDG at the end of this section.** Alternatively, Grundfoss® Model UPS 26-99 or Taco® Model 0011 pumps or other brands with similar pumping capability may be used. The single pump module will typically handle systems up to 3 tons (model size 45); the two pump module will typically handle 4 to 6 ton systems (model sizes 55, 65, 75). This is based on a typical parallel system with one circuit per ton.

Maritime Geothermal recommends calculating the total pressure drop of the ground loop (including headers, indoor piping and heat pump exchanger drop) based on the antifreeze type and concentration at the desired minimum loop temperature. A pump module that can deliver the flow required for the unit at the calculated total pressure drop should be selected. **Refer to the Model Specific Information section** for unit flow requirements.

Loop pressure drops can be calculated using software such as those mentioned in the Horizontal Ground loops section, or can be calculated in a spreadsheet using the pipe manufacturer's pressure drop tables for pipe diameter and fittings.

The circulator pump module must be connected to the heat pump Outdoor Loop ports with a lineset suitable for the flow required with minimum pressure drop. 1" rubber or plastic lines should be used. The installation of P/T plugs (pressure / temperature, pronounced "*Pete's plugs"*) is recommended on both the entering and leaving lines at the heat pump **(see Diagram C).**

DIAGRAM C - Typical P/T (Pete's) Plug & Thermometer Stems


P/T Plugs
(Pete's Plug)
BRASS
Gage Adaptor
THE PRESSURE GAGE ADAPTOR HAS A ¼ DIAMETER PROBE OF 304 STAINLESS STEEL WITH UNION NUT. SIMPLY ATTACH YOUR GAGE/TRANSDUCER AND INSERT THE PROBE THROUGH AN OMEGA PLUG TO TAKE A READING.
2"
1/4"
Protective Cover Included
STAINLESS STEEL
BRASS
1. CAP & GASKET
2. TWO NEOPRENE OR NORDEL SELF-CLOSING VALVES
3. VALVE POCKET FOR ADDED PRESSURE PROTECTION
4. PROCESS THREAD
5. VALVE RETAINER

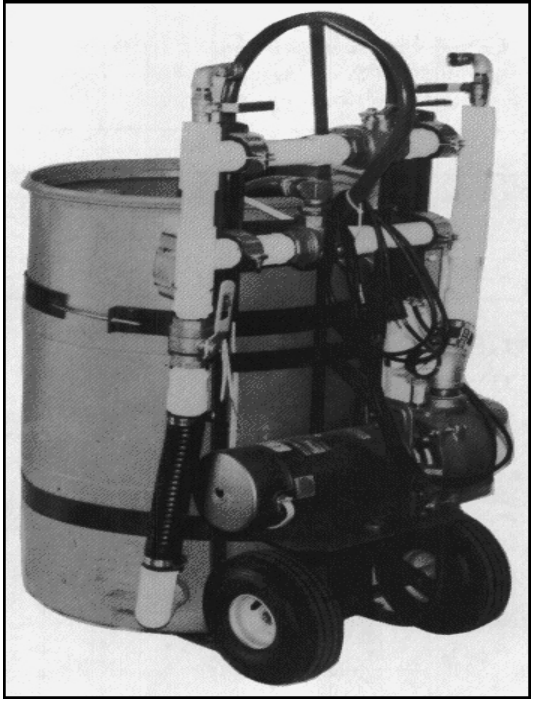
The P/T plug will allow the installer or homeowner to check water flow through the loop by measuring the pressure difference through the heat exchanger and comparing it to that listed in the **Model Specific Information section**, or the specifications document. Optional fittings with P/T ports are available for the circulator pump modules sold by Maritime Geothermal Ltd..

FLUSHING & PURGING THE GROUND LOOP

Once the groundloop has been installed and all connections are completed between the heat pump, circulator pump module and ground loop, the entire ground loop system should be **pressure tested with air to 100 PSIG** to make sure there are no leaks on any of the inside fittings. Soap all joints and observe that the pressure remains constant for 1 hour.

When satisfied that all connections are leak free, release the air pressure and connect a purge cart **(see Diagram D)** to the flushing access ports at the pump module **(refer to drawing 000906CDG)**. A temporary flushing system can alternately be constructed using a 45 gal. barrel and a pump with sufficient volume and head capability to circulate fluid at a **velocity of at least 2 ft./min.** through all parts of the loop.

DIAGRAM D - Typical Purge Cart



Adjust the circulator pump module valves to connect the purge cart to the ground loop. Begin pumping water through the ground loop, ensuring that the intake of the pump stays submerged at all times by continuously adding water. Water flowing back from the return line should be directed below the water level in the barrel or flush tank to prevent air being mixed with the outgoing water.

Once the lines have been filled and no more air bubbles are appearing in the line, adjust the circulator pump module valves to circulate water through the heat pump using the same technique as described above. When all air is removed reverse the flow of water through the lines by interchanging the flush cart lines and purge again. You will be able to visibly tell when all air is removed.

ADDING ANTIFREEZE SOLUTION

In most mid and northern areas of the US and in all of Canada it is necessary to condition the loop fluid by the addition of some type of antifreeze solution so that it will not freeze during operation in the winter months. This antifreeze is required because the loop fluid will normally reach a low entering temperature of **28°F to 32°F (-2°C to 0°C)** and refrigerant temperatures inside the heat pump's heat exchanger may be as low as **20°F (11°C)** cooler. See **TABLE 14** for details of freeze protection provided by different concentrations.

TABLE 14 - Antifreeze Percentages

BY VOLUME				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	25%	21%	16%	10%
Propylene Glycol	38%	30%	22%	15%
BY WEIGHT				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	16.8%	13.6%	10%	6.3%
Propylene Glycol	30%	23.5%	18.3%	12.9%

NOTE: Add enough antifreeze to allow for a temperature 20°F (11°C) lower than the expected lowest loop fluid temperature entering the heat pump.

Although many different antifreeze solutions have been employed in geothermal systems, the alcohols such as methanol or ethanol have the most desirable characteristics for groundloop applications. The overall heat transfer characteristics of these fluids remain high although care must be taken when handling pure alcohols since they are extremely flammable. Once mixed in a typical 25% by volume ratio with water the solution is not flammable. In situations where alcohols are not allowed as a loop fluid due to local regulations then propylene glycol is a non-toxic alternative which can be substituted . Propylene glycol should only be used in cases where alcohols are not permitted since the heat transfer characteristics are less desirable and it becomes more viscous at low temperatures, increasing pumping power.

The volume of fluid that your loop system holds can be closely estimated by totaling the number of ft. of each size pipe in the system and referencing **TABLE 15** the for approximate volume per 100 ft.

When the volume of the loop has been calculated and the appropriate amount of antifreeze is ready for addition by referencing **TABLE 14** , drain the equivalent amount of water from the flush cart or mixing barrel and replace it with the antifreeze.

When using alcohols, be sure to inject below the water line to reduce initial volatility of the pure antifreeze. If the loop is large it may be necessary to refill the tank with antifreeze several times to get all the antifreeze into the loop. Pump the loop for 5 to 10 minutes longer to ensure the remaining fluid has been well mixed.

TABLE 15 - Volume of fluid per 100 ft. of pipe

		Volume /100ft.		
Type of Pipe	**Diameter**	**Igal**	**USgal**	**L**
Copper	**1"**	**3.4**	**4.1**	**15.5**
	1-1/4"	**5.3**	**6.4**	**24.2**
	1-1/2"	**7.7**	**9.2**	**34.8**
Rubber Hose	**1"**	**3.2**	**3.9**	**14.8**
Polyethylene	**3/4" IPS SDR11**	**2.3**	**2.8**	**10.6**
	1" IPS SDR11	**3.7**	**4.5**	**17.0**
	1-1/4" IPS SDR11	**6.7**	**8.0**	**30.3**
	1-1/2" IPS SDR11	**9.1**	**10.9**	**41.3**
	2" IPS SDR11	**15.0**	**18.0**	**68.1**
Other Item Volumes				
Heat Exchanger	**Average**	**1.2**	**1.5**	**5.7**
Purge Cart Tank	**See cart manual**	**TBD**		

INITIAL PRESSURIZATION

At this point open all valves in the flow circuit and slowly close off the supply and return flush cart valves in a manner that leaves about **20-30 psig**. on the system. If an air bladder expansion tank is used it should be charged to the above pressure before actual water pressure is put on the system . Systems without an expansion tank will experience greater fluctuations in pressure between the heating and cooling seasons, causing pressure gauges to have different values as the loop temperature changes. This fluctuation is normal since expansion and contraction of the loop fluid must be handled by the elasticity of the plastic loop.

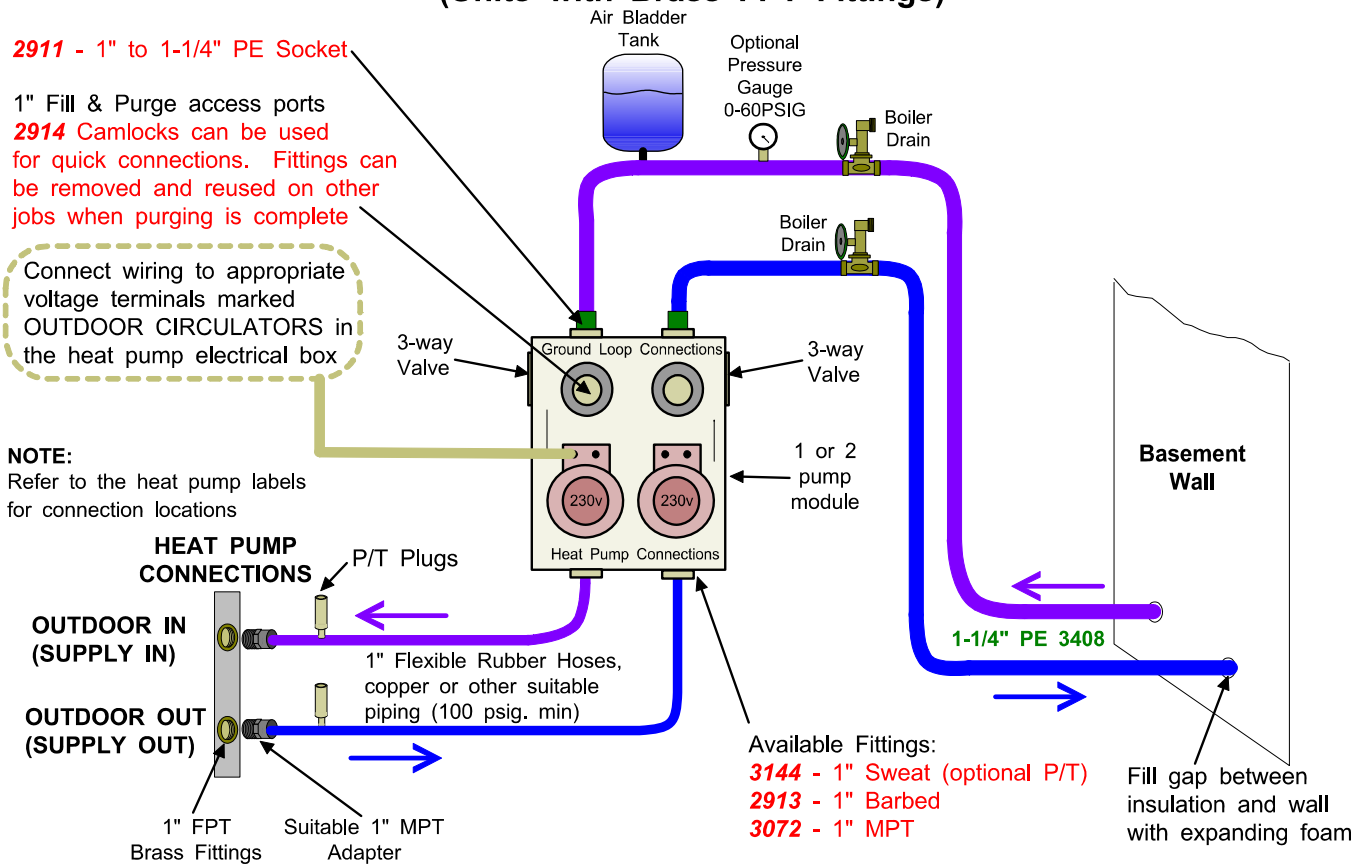
- Pressurize the loop to a static pressure of **45 psig**. when installing a system in the fall going into the heating season.
- Pressurize the loop to a static pressure of **25 psig**. when installing a system in the spring or summer going into the cooling season.

After operating the heat pump for a period of time, any residual air in the system should be bled off and the static pressure should be verified and adjusted if necessary. Add additional water / antifreeze mix with the purge cart to bring the pressure back to the original setting if required.

PIPE INSULATION

All ground loop piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls.

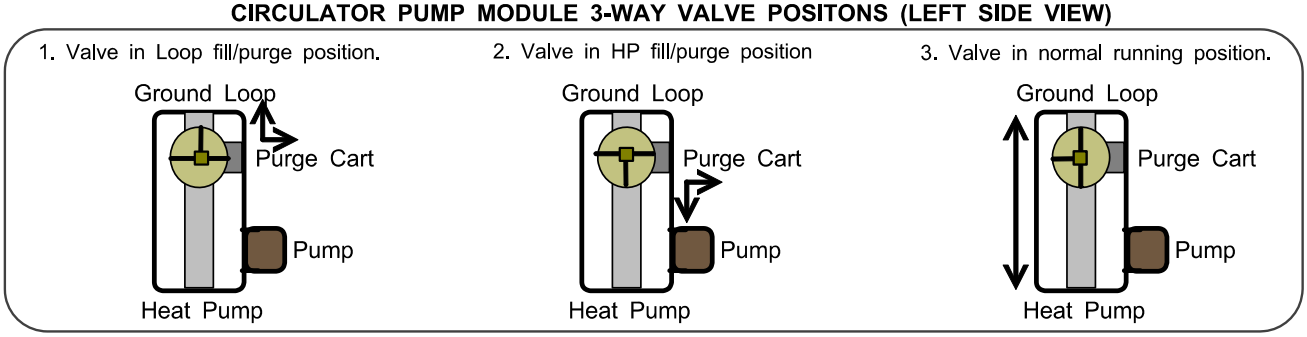
Geo-Flo Circulator Pump Module Installation
(Units with Brass FPT Fittings)


Air Bladder Tank
Optional Pressure Gauge 0-60PSIG
Boiler Drain
Boiler Drain
2911 - 1" to 1-1/4" PE Socket
1" Fill & Purge access ports
2914 Camlocks can be used for quick connections. Fittings can be removed and reused on other jobs when purging is complete
Connect wiring to appropriate voltage terminals marked OUTDOOR CIRCULATORS in the heat pump electrical box
3-way Valve
Ground Loop Connections
3-way Valve
1 or 2 pump module
230v
230v
Heat Pump Connections
Basement Wall
NOTE:
Refer to the heat pump labels for connection locations
HEAT PUMP CONNECTIONS
P/T Plugs
OUTDOOR IN (SUPPLY IN)
OUTDOOR OUT (SUPPLY OUT)
1" Flexible Rubber Hoses, copper or other suitable piping (100 psig. min)
1-1/4" PE 3408
Available Fittings:
3144 - 1" Sweat (optional P/T)
2913 - 1" Barbed
3072 - 1" MPT
Fill gap between insulation and wall with expanding foam
1" FPT Brass Fittings
Suitable 1" MPT Adapter

NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd., Geo-Flo Part Numbers are indicated above (italics).
- A pressure gauge is recommended if P/T plugs are not installed.
- The air bladder tank should be pressurized to the desired static pressure of the ground loop before installation.
- For most applications, a 1 pump module will accomodate NORDIC models sizes 25 and 45, and a 2 pump module will accomodate sizes 55, 65 and 75. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



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01	Initial Release	C. GEDDES	C. GEDDES	09 DEC 08

Drawn By: Chris Geddes	Date: 09 DEC 08	
Checked By: Chris Geddes	Date: 09 DEC 08	
Approved By (ENG): Chris Geddes	Date: 09 DEC 08	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Geo-Flo Circulator Pump Module Installation (Brass FPT)

Size	Drawing Number	REV	SHEET
A	000906PDG	01	1 of 1

Startup Procedure

The following steps describe how to perform the startup procedure of the geothermal heat pump.

The TF-Series Two-Stage R410a Air and Hydronic Startup Records located in this manual are used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer and a copy should be sent to Maritime Geothermal Ltd.

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

PRE-START INSPECTION

Ductwork:

1. Verify that all ductwork has been completed and is firmly attached to the unit. Verify that any dampers or diverters are properly set for operation of the heat pump.
2. Verify that all registers are open and clear of any objects that would restrict the airflow.
3. Verify that a new air filter is installed and the cover is secured.
4. Verify the condensate drain is connected, properly vented and free of debris.
5. If a plenum heater has been installed, verify that it is securely fastened to the ductwork.

Indoor Loop (Hydronic Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the indoor loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze (if used) for the intended application. Record the type of antifreeze and the mixture value on the startup sheet, circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the ground loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze for the intended application. Record the type of antifreeze and the mixture value on the startup sheet; circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Water):

1. Verify there are no leaks in the connections to the unit. Verify the water valve is installed and properly oriented in the return line.
2. Verify that there is flow control in the return line.

Domestic Hot Water (if equipped):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the domestic hot water tank.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the brown wire with the insulated terminal is disconnected in the electrical box. Refer to the schematic diagram for more information.

Electrical:

1. **Ensure the power to the unit is off. Ensure the power to the plenum heater is off if equipped.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight and the ground wire is connected tightly to the ground connector for the heat pump and plenum heater.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump. Record the fuse / circuit breaker size, wire gauge and size of the plenum heater if installed.
4. Verify that the control connections to the thermostat and plenum heater (if installed) are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Ensure all access panels except the lower one that provides access to the electrical box are in place.

UNIT STARTUP (AIR)

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**

Preparation:

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set the thermostat to OFF. Set up the thermostat as per the instructions provided with it so that it will function properly with the heat pump system (set for heat pump, not for heating and cooling). The O signal should be set to active in cooling mode.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

Air Heating Mode:

1. Set the aquastat so that both Stage 1 and Stage 1 are off.
2. Set the thermostat to heating mode and adjust the setpoint to activate Stage 1 and Stage 2. The fan should slowly ramp up to speed after the time delay of the thermostat expires (if applicable) and the compressor will start (allow 30-60 seconds for the water valve to open for ground water systems)
3. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
4. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
    1. Suction pressure
    2. Discharge pressure
    3. Duct Return temperature (poke a small hole in the flex collar and insert probe in airstream)
    4. Duct Supply temperature (poke a small hole in the flex collar and insert probe in airstream)
    5. Duct Delta T (should be between **22-32°F, 12-18°C**)
    6. Outdoor Loop In (Supply In) temperature
    7. Outdoor Loop Out (Supply Out) temperature
    8. Outdoor Delta T (should be between **5-8°F, 3-4°C**)
    9. Outdoor flow (if available)
    10. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
5. Adjust the thermostat setpoint to the desired room temperature and let the unit run through a cycle. Record the setpoint, suction, discharge pressures when the unit shuts off.
6. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the DHW Switch in the unit post on. Turn the power to the unit on.
7. Remove the electrical cover from the plenum heater. Place a current clamp meter around one of the supply wires. Turn on the power to the plenum heater. Adjust the thermostat setpoint to **85°F (29°C)**. Verify that the current draw increase as each stage is activated. (10kW has 2 stages, 15kW has 3 stages and 20kW has 4 stages).
8. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Cooling Mode:

1. Set the thermostat to cooling mode and adjust the setpoint to activate Stage 1 and Stage 2.
2. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
    1. Suction pressure
    2. Discharge pressure
    3. Duct Return temperature
    4. Duct Supply Out temperature
    5. Duct Delta T
    6. Outdoor Loop In (Supply In) temperature
    7. Outdoor Loop Out (Supply Out) temperature
    8. Outdoor Delta T
3. Adjust the thermostat setpoint to the desired room temperature if possible, otherwise set it just low enough to allow the unit to run (ie 1°F (0.5°C) less than room temperature) and let the unit run through a cycle. Record the thermostat setpoint, suction, And discharge pressures when the unit shuts off.

Final Inspection: (If the Hydronic Startup is to be performed as well, do the Final Inspection after is has been completed.)

1. Turn the power off to the unit (and plenum heater if installed) and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss. Install the electrical cover on the plenum heater if applicable.
3. Do a final check for leaks in the ground water / ground loop system and ensure the area is clean.
4. Turn the power on to the unit and the plenum heater if installed. Set the thermostat to the final settings.

Startup Record:

1. The installer shall sign and date the Startup Record and have the homeowner sign as well. The installer shall leave the Startup Record with the homeowner, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record (Air) —TF-Series Size 25-75 Two-Stage R410a

Installation Site		**Startup Date**	**Installer**		
City			**Company**		
Province		**Check boxes unless asked to record data. Circle units.**	**Model**		
Country			**Serial #**		
Homeowner Name		**Homeowner Phone #**			

PRE-START INSPECTION

Ductwork	Ductwork is completed, dampers/ diverters are adjusted							
	Registers are open and clear of objects							
	Air filter and end cap are installed							
	Condensate Drain is connected, properly vented and free of debris							
	Plenum heater is securely fastened (if applicable)							
Ground Loop System	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Water System	Water Valve installed in return line							
	Flow control installed in return line							
Domestic Hot Water	All shut-off valves are open							
	Lines are full and purged							
	Desuperheater pump wire is disconnected							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.			
	Circuit breaker (or fuse) size, wire gauge, and Plenum Heater size		A		Ga.		kW	
	Low voltage connections are correct and securely fastened							

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Duct Return, Duct Supply, and Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C
	Outdoor Flow		Igpm	USgpm		L/s		
	Compressor L1 (black wire) current		A					
	Domestic Hot Water functioning							
	Thermostat setpoint and discharge pressure at cycle end		°F	°C			psig	kPa
Cooling Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Duct Return, Indoor Out, and Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C
	Thermostat setpoint and suction pressure at cycle end		°F	°C			psig	kPa

Date:		**Installer Signature:**		**Homeowner Signature:**	

A total of three copies are required, one for the homeowner, one for the installer and on to be sent to Maritime Geothermal Ltd.

UNIT STARTUP (HYDRONIC)

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit controlled by an aquastat. **It is recommended that safety glasses be worn during the following procedures.**

Preparation:

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set all controls (including all zone thermostats) to OFF.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

Heating Mode:

1. Set the heating aquastat setpoints to activate Stage 1 and Stage 2. The compressor will start (allow 30-60 seconds for the water valve to open for ground water systems) as well as the circulator pumps.
2. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
    1. Suction pressure
    2. Discharge pressure
    3. Indoor Loop In (Hot In) temperature
    4. Indoor Loop Out (Hot Out) temperature
    5. Indoor Delta T (should be between **8-12°F, 4-6°C**)
    6. Outdoor Loop In (Supply In) temperature
    7. Outdoor Loop Out (Supply Out) temperature
    8. Outdoor Delta T (should be between **5-8°F, 3-4°C**)
    9. Outdoor flow (if available)
    10. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the aquastat setpoint to the desired buffer tank temperature and let the unit run through a cycle. Record the setpoint, suction, and discharge pressures when the unit shuts off.
5. Proceed to Final Inspection if the desuperheater (if applicable) has already been tested during the Air Startup.
6. Open a zone (or zones) and let the tank cool down until Stage 2. is activated. Close the zone(s) again.
7. Turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the DHW Switch in the unit post on. Turn the power to the unit on.
8. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks in the ground water / ground loop system and ensure the area is clean.
4. Turn the power on to the unit. Set the aquastat to the final settings and record the values.

Startup Record:

1. The installer shall sign and date the Startup Record and have the homeowner sign as well. The installer shall leave the Startup Record with the homeowner, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record Sheet (Hydronic)—TF-Series Size 25-75 Two-Stage R410a

Installation Site		**Startup Date**	**Installer**	
City			**Company**	
Province			**Model**	
Country			**Serial #**	

Check boxes unless asked to record data, circle units

PRE-START INSPECTION

Indoor Loop (Hydronic)	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Loop System	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Water System	Water Valve installed in return line							
	Flow control installed in return line							
Domestic Hot Water	All shut-off valves are open							
	Lines are full and purged							
	Desuperheater pump wire is disconnected							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.			
	Circulator pump voltages (Outdoor 1, Outdoor 2, Indoor 1)		V		V		V	
	Low voltage connections are correct and securely fastened							

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C
	Outdoor Flow		lgpm	USgpm		L/s		
	Compressor L1 (black wire) current		A					
	Domestic Hot Water functioning							
	Aquastat setpoint and discharge pressure at cycle end		°F	°C			psig	kPa
Final Settings	S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	

Date:		**Installer Signature:**		**Homeowner Signature:**	

A total of three copies are required, one for the homeowner, one for the installer and on to be sent to Maritime Geothermal Ltd.

General Maintenance

GENERAL MAINTENANCE SCHEDULE		
Item	**Interval**	**Procedure**
Air Filter	6 months	Inspect for dirt. Replace if necessary.
Contactor	1 year	Inspect for pitted or burned points. Replace if necessary.
Condensate Drain	1 year	Inspect for clogs. Remove and clean if necessary.
Heat exchanger	As required*	Clean as per HEAT EXHCANGER FLUSING PROCEDURE below.
***Generally not required for closed loop systems. Whenever system performance is reduced for open loop.**		

COAXIAL HEAT EXCHANGER FLUSHING PROCEDURE—GROUNDWATER	
STEP 1	Isolate the heat exchanger by closing the valves in the IN and OUT ports to the heat exchanger.
STEP 2	Blow out the heat exchanger into a clean 5 gallon bucket using compressed air.
STEP 3	If a purge cart is not available, use a 5 gallon plastic bucket, a circulator and some plastic piping to create a makeshift pump system. Connect a the inlet and outlet to the heat exchanger ports.*
STEP 4	Place 2 gallons of RYDLYME in the purge cart (or bucket). Circulate the fluid through the heat exchanger for at least 2 hours (3 recommended).
STEP 5	Disconnect the purge system dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain.
STEP 6	Connect fresh water and a drain to the heat exchanger ports and flush the exchanger for several minutes.
STEP 7	Return the plumbing to its original configuration and open the IN and OUT valves. Operate the system and check for improved performance.
***Depending on the plumbing, there should be either unions or boiler drains for to access the heat exchanger.	

COAXIAL HEAT EXCHANGER FLUSHING PROCEDURE—GROUND LOOP	
STEP 1	Isolate the heat exchanger by placing the pump module valves in the exchanger flushing position.
STEP 2	Connect a compressed air and a drain pipe to the pump module purge ports and blow the anti-freeze solution into a clean 5 gallon bucket.
STEP 3	Connect a purge cart to the pump module purge ports.
STEP 4	Place 2 gallons of RYDLYME in the purge cart. Circulate the fluid through the heat exchanger for at least 2 hours (3 recommended).
STEP 5	Disconnect the purge cart and dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain. Clean the purge cart thoroughly.
STEP 6	Connect fresh water and a drain to the pump module purge ports and flush the exchanger for several minutes.
STEP 7	Blow the heat exchanger out with compressed air as per STEP 2 and dump the water down a drain.
STEP 8	Connect the purge cart to the pump module purge ports. Re-fill and purge the heat exchanger with as per standard procedures (the anti-freeze from STEP 2 can be re-used).
STEP 9	Disconnect the purge cart and set the pump module valves back to the original positions.
STEP 10	Operate the system and check for improved performance.
***Depending on the plumbing, there should be either unions or boiler drains for to access the heat exchanger.	

Troubleshooting Guide

The following steps are for troubleshooting the geothermal heat pump. If the problem is with the domestic hot water or the plenum heater, proceed to those sections at the end of the troubleshooting guide. Repair procedures and reference refrigeration circuit diagrams can be found at the end of the troubleshooting guide.

STEP 1: Verify that the display is present on the thermostat. If it is not, proceed to POWER SUPPLY TROUBLESHOOTING, otherwise proceed to STEP 2.

STEP 2: Remove the door and electrical box cover and check to see if there is a fault code on the control board. If there is, record the fault code. Turn the power off, wait 10 seconds and turn the power back on. Set the thermostat to call for heating or cooling depending on the season, or set the aquastat to call for heating.

STEP 3 (Air): If a 24VAC signal does not appear across Y1 and C of the terminal strip within 6 minutes, proceed to the THERMOSTAT TROUBLESHOOTING section, otherwise proceed to STEP 4.

STEP 3 (Hydronic): If a 24VAC signal does not appear across Y1A and CA of the terminal strip, proceed to the HYDRONIC TROUBLESHOOTING - AQUASTAT section, otherwise proceed to STEP 4.

STEP 4: If a fault code appears once a signal is present at Y1 and the compressor does not attempt to start, proceed to the FAULT CODE TROUBLESHOOTING section, otherwise proceed to STEP 5.

STEP 5: If The compressor does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section, otherwise proceed to STEP 6.

STEP 6: If the compressor starts and sounds normal, this means the compressor is OK and the problem lies elsewhere. Proceed to the AIR OPERATION TROUBLESHOOTING section or the HYDRONIC OPERATION TROUBLESHOOTING section.

NOTE: To speed up the troubleshooting process, the Test Jumper on the safety board can be placed to the YES position to change the anti-short cycle timer to 5 seconds. **Be sure to set it back to NO when servicing is complete**.

POWER SUPPLY TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No power to the heat pump	Disconnect switch open (if installed)	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened, if all is OK close the switch.
	Fuse blown / Breaker Tripped.	At heat pump disconnect box, voltmeter shows 230VAC on the line side but not on the load side.	Reset breaker or replace fuse with proper size and type. (Time-delay type “D”)
No display on thermostat.	Transformer breaker tripped.	Breaker on transformer is sticking out.	Push breaker back in. If it trips again locate cause of short circuit and correct.
	Faulty transformer	Transformer breaker is not tripped, 230VAC is present across L1 and L3 of the compressor contactor but 24VAC is not present across R_H and C of the terminal strip.	Replace transformer.
	Faulty wiring between heat pump and thermostat.	24VAC is not present across C and R(R_H) of the thermostat.	Correct the wiring.
	Faulty Thermostat.	24VAC is present across C and R (R_H) of the thermostat but thermostat has no display.	Replace thermostat.

THERMOSTAT TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No Y1 signal to heat pump (after 6 minutes)	Incorrect thermostat set-up.	Thermostat does not indicate a call for heat. No 24VAC signal present across C and Stage 1 of the thermo-stat	Correct the setup.
	Faulty thermostat to heat pump wiring.	24VAC signal present across Stage 1 and C of the thermostat but not present across Y1 and C of the ter-minal strip.	Correct or replace wiring
	Faulty thermostat.	No 24VAC between Stage 1 and C of the thermostat when a call is indi-cated on the thermostat.	Replace thermostat.

FAULT CODE TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Fault Code 1 (High Pressure Control)	Faulty High Pressure Con-trol (open). * Must be a signal present on Y1 for this test. *HP pressures must be at static levels.	Verify if there is 24VAC across HP1 on the control board and C of the ter-minal strip, as well as HP2 and C.	Replace high pressure control if voltage is present on HP1 but not on HP2.
	Faulty control board.	24VAC is present across HP1 and C1, and HP2 and C, but no voltage is present across CC on the control board and C.	Replace control board.
Fault Code 2 (Low Pressure Control)	Faulty Low pressure con-trol (open). * Must be a signal present on Y1 for this test. *HP pressures must be at static levels.	Verify if there is 24VAC across LP1 on the control board and C of the ter-minal strip, as well as LP2 and C.	Replace high pressure control if voltage is present on LP1 but not on LP1.
	Faulty control board.	24VAC is present across LP1 and C, and LP2 and C, but no voltage is present across CC on the control board and C.	Replace control board.
	Unit out of refrigerant.	Check static refrigeration pressure of the unit for a very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
Fault Code 3 (Flow Switch)	Flow switch jumper re-moved or faulty.	Verify jumper is in place between pins marked FLOW SWITCH.	Place a jumper if missing.
	Flow switch faulty. (Only if installed)	Verify 24VAC is present between each flow switch pin on the control board and the C terminal of the ter-minal strip while there is flow through the unit.	Replace flow switch if signal is not present at both terminals on the control board.
	Faulty control board.	24VAC is present across each FLOW SWITCH terminal and C, but not voltage is present across CC on the control boardand C.	Replace control board.

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start	Faulty control board.	Measuring from C on the terminal strip, verify there is voltage at Y, HP1, HP2, LP1, LP2, and both flow pins but no voltage present at CC.	Replace control board.
	Faulty run capacitor. (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor.	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped.	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism.	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential Relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is “tight” due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor Stage 2 will not activate	Faulty Stage 2 module	Verify if 24VAC is present across Y2 and C of the terminal strip.	Replace module if signal is present. Check wiring if signal is not present.

AIR OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Discharge Pressure	Air Flow	See Fan Troubleshooting section	Correct the problem.
	TXV adjusted too far closed.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be high if TXV is closed too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Filter-drier plugged	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Unit is overcharged. (Only possible if unit has been opened in the field and incorrectly charged)	High sub-cooling, low delta T across air coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
Low Suction Pressure	Low or no Outdoor liquid flow	Delta T across the Outdoor Loop ports should be between 5-7°F (3-4°C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems. Verify well pump and water valve is working for ground water systems.
	Entering liquid temperature too cold.	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled coaxial heat exchanger. (typically for ground water, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Have a qualified service technician backflush the coaxial exchanger.
	Return air too cold	Measure return air temperature. Should be above 60°F (15°C).	Restrict air flow temporarily until room comes up to temperature.
	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking check valve. (Located in the receiver liquid line out).	Valve will be cold. Remove the cap from the roto-lock fitting on the receiver and close the roto-lock valve. Unit should function normally, there may be a sound change as the roto-lock is closed.	Try tapping the valve and switching from air heat to water heat a few times. Replace the check valve if the problem persists.
	Low refrigerant charge.	Entering liquid temperature, flow and entering air temperature are good but suction is low. Check static refrigeration pressure of the unit for a very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.

AIR OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Suction Pressure (may appear to not be pumping)	TXV adjusted too far open.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck open.	Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking reversing valve#1.	Reversing valve has uniform temperature, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Leaking reversing valve#2.	Reversing valve has uniform temperature, common suction line is warm, compressor is running hot. Does not work in air heat or water heat but does work in air cool.	Replace reversing valve.
Compressor frosting up	See Low Suction Pressure in this section.		
TXV frosting up	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the high pressure control.	Replace contactor.
	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.

AIR OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Thermostat not set up properly.	Verify that there is 24VAC across O/B/W1 and C of the terminal strip when calling for cooling.	Correct thermostat setup. Change to a different thermostat.
	Faulty reversing valve#1 solenoid coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed.	Replace solenoid if faulty.
	Faulty reversing valve#1.	A click can be heard when the coil is energized but the unit continues to heat instead of cool.	Replace reversing valve.
High Discharge pressure	Low or no Outdoor liquid flow	Delta T across the Outdoor Loop ports should be between 8-12F (4-7C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify pumps are working for ground loop systems. Verify well pump and water valve is working for ground water systems.
	Entering liquid temperature too warm.	Most likely caused by undersized ground loop.	Verify the ground loop sizing. Increase the size of the ground loop if undersized.

AIR OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Discharge pressure (continued)	Dirty or fouled coaxial heat exchanger. (typically for ground water, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Have a qualified service technician backflush the coaxial exchanger.
	Unit is overcharged. (Only possible if unit has been opened in the field and incorrectly charged)	High sub-cooling, low delta T across water coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
High Suction Pressure (may appear to not be pumping)	TXV adjusted too far open.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck open.	Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking reversing valve#1.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve#1.
Low Suction Pressure	Air Flow	See Fan Troubleshooting section. **Note:** low airflow will cause the air coil to ice up once the suction drops below **90PSIG**.	Correct the problem.
	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking check valve. (Located in the receiver liquid line out).	Valve will be cold. Remove the cap from the roto-lock fitting on the receiver and close the roto-lock valve. Unit should function normally, there may be a sound change as the roto-lock is closed.	Try tapping the valve and switching from air cool to water heat a few times. Replace the check valve if the problem persists.
	Low or no refrigerant charge.	Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
TXV frosting up	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Random Low Pressure trip (does not occur while there)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the low pressure control.	Replace contactor.
	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.

FAN TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low Airflow	Dirty air filter	Inspect.	Replace.
	Dirty air coil.	Inspect.	Clean.
	Poor Ductwork	Measure delta T between supply and return ducts at the unit, it in heating mode, it should not be above 30°F(17°C).	The ECM fan will provide proper airflow up to 0.5 inH2o for 1/2HP motors and 0.7 inH2o for 1HP motors. The ductwork is poorly designed or greatly undersized if the fan motor cannot provide the required airflow.
	Air flow selected on Tap Board is too low.	Check selection on Air Flow Tap Board.	Select a higher setting.
	Air flow reduction is enabled.	AR1 and AR2 are connected with a dry contact.	Air flow reduction may not be feasible with poor ductwork, and/or lower Air Flow selections. Increase settings until unit operates properly.
Fan operating on wrong Stage speed	Fan Control Signal Harness is loose.	Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector.	Repair any loose connections.
	Faulty Control Signal Harness or faulty motor head. **Ensure signal is present on terminal strip.**	Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector): Circulation = Grey (pin 15) Stage 1 = Yellow (pin 6) Stage 2=Yellow/Black (pin14) Stage 3 = Violet (pin 2)	If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head.
Fan not operating or operating intermittently	Fan Control Signal Harness and/or Fan Power Harness is loose.	Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector.	Repair any loose connections.
	Faulty Control Signal Harness or faulty motor head. **Ensure signal is present on terminal strip.**	Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector): Circulation = Grey (pin 15) Stage 1 = Yellow (pin 6) Stage 2=Yellow/Black (pin14) Stage 3 = Violet (pin 2)	If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head.
	Faulty Fan Power Harness or faulty motor.	Insert the tips of the voltmeter probes into the back of the connector at the fan to measure the voltage across the red and black wires, value should be 230VAC	Replace Power Harness if 230VAC is not present, replace motor if 230VAC is present

HYDRONIC TROUBLE SHOOTING - AQUASTAT			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No display on aquastat.	Transformer breaker tripped.	Breaker on transformer is sticking out.	Push breaker back in. If it trips again locate cause of short circuit and correct.
	Faulty transformer	Transformer breaker is not tripped, 230VAC is present across L1 and L3 of the compressor contactor but 24VAC is not present across R and C.	Replace transformer.
	Faulty wiring between heat pump and aquastats.	24VAC is not present across 24V and COM at the top of the aquastat.	Correct the wiring.
	Faulty aquastat.	24VAC is present across 24Vand COM of the aquastat but there is no display.	Replace aquastat.
No Y1A signal to heat pump	Incorrect aquastat setup.	Aquastat does not indicate S1 on the display.	Correct the setup.
	Faulty aquastat to heat pump wiring.	24VAC not present across Stage 1 C and COM of the aquastat.	Correct or replace wiring.
	Faulty aquastat to heat pump wiring.	24VAC signal present across Stage 1 NO and COM of the aquastat but not present across Y1A and CA of the terminal strip.	Correct or replace wiring.
	Faulty aquastat.	No 24VAC between Stage 1 NO and COM of the aquastat when S1 is indicated on the aquastat display.	Replace aquastat.
No Y2A signal to heat pump	Incorrect aquastat setup.	Aquastat does not indicate S2 on the display.	Correct the setup.
	Faulty aquastat to heat pump wiring.	24VAC not present across Stage 2 C and COM of the aquastat.	Correct or replace wiring.
	Faulty aquastat to heat pump wiring.	24VAC signal present across Stage 2 NO and COM of the aquastat but not present across Y2A and CA of the terminal strip.	Correct or replace wiring.
	Faulty aquastat.	No 24VAC between Stage 2 NO and COM of the aquastat when S2 is indicated on the aquastat display.	Replace aquastat.
Setting(s) not retained	Faulty aquastat	E2 error message. Can cause the unit to trip a safety control if the set-ting is too high or low.	Replace aquastat.

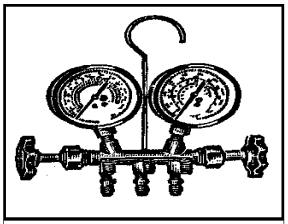
HYDRONIC OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Discharge Pressure	Aquastat set too high.	Verify aquastat setting	Lower aquastat setting to recommended value of **115°F (46°C)**
	Low or no Indoor loop flow.	Delta T across the Indoor Loop ports should be between 8-12°F (3-6°C), or compare pressure drop to the tables for the unit.	Verify pump is working and sized correctly. Check for restrictions in the circuit, ie valve partially closed.
	TXV adjusted too far closed.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be high if TXV is closed too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Filter-drier plugged	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Unit is overcharged. (Only possible if unit has been opened in the field and incorrectly charged)	High sub-cooling, low delta T across air coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
	Faulty reversing valve#2 solenoid coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed.	Replace solenoid if faulty.
	Faulty reversing valve#2.	A click can be heard when the coil is energized but the unit will not switch to water heating mode.	Replace reversing valve.
Low Suction Pressure	Low or no Outdoor liquid flow	Delta T across the Outdoor Loop ports should be between 5-7°F (3-4°C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems. Verify well pump and water valve is working for ground water systems.
	Entering liquid temperature too cold.	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled coaxial heat exchanger. (typically for ground water, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Have a qualified service technician backflush the coaxial exchanger.
	Indoor Loop entering liquid temperature too cold	Measure temperature. Should be above 60°F (15°C).	Restrict Indoor liquid flow temporarily until buffer tank comes up to temperature.

HYDRONIC OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low Suction Pressure (continued)	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Faulty NO solenoid valve coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be an audible click sound if the solenoid is working.	Replace solenoid if faulty.
	Faulty NO solenoid valve.	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Leaking check valve. (Located in parallel with the NO valve.	Valve will be cold instead of warm.	Try tapping the valve and switching from air heat to water heat a few times. Replace the check valve if the problem persists.
	Low refrigerant charge.	Entering liquid temperature, flow and entering air temperature are good but suction is low. Check static refrigeration pressure of the unit for a very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
High Suction Pressure (may appear to not be pumping)	Leaking reversing valve#1.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	TXV adjusted too far open.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck open.	Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking check valve. (Located beside reversing valve#2)	3/4" pipe and check valve going into air coil is hot. Unit works properly in air heating mode.	Replace check valve.
Compressor frosting up	See Low Suction Pressure in this section.		
TXV frosting up	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it shouldn't, tripping the high pressure control.	Replace contactor.
	Intermittent Indoor circulator.	Verify wiring is good	Correct the wiring or replace the circulator.

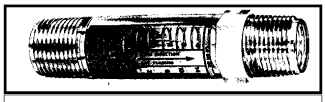
PLENUM HEATER TROUBLE SHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No 230VAC across plenum heater L1 and L2	Disconnect switch open. (if installed)	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened, if all is OK close the switch.
	Fuse blown / Breaker Tripped.	At plenum heater disconnect box (if installed), voltmeter shows voltage on the line side but not on the load side. Check if breaker is tripped.	Reset breaker or replace fuse at plenum heater disconnect box. Replace fuse with proper size and type. (Time-delay type “D”)
	Same “Line” to L1 and L2	Measuring L1 to ground and L2 to ground both yield 115VAC, but L1 to L2 yields 0VAC.	Correct wiring.
No W2 signal at Heat pump terminal strip	No call for auxiliary or emergency heat from thermostat.	Verify that the thermostat is indicating that auxiliary or emergency heat should be on.	Set thermostat to engage auxiliary or emergency heat (note some thermostats require a jumper between auxiliary and emergency. Check the thermostat manual).
	Faulty thermostat.	Thermostat doesn’t indicate a call for auxiliary or emergency when it should.	Replace thermostat.
	Faulty thermostat.	Thermostat indicates auxiliary or emergency but no 24VAC signal present across C and the auxiliary and/or emergency pin at the thermostat.	Replace thermostat.
	Faulty thermostat wiring.	24VAC signal is present across C and the auxiliary and/or emergency pin at the thermostat but no 24VAC signal is present across W2 and C at the heat pump terminal strip.	Correct wiring.
No 24VAC signal from C to ground at the plenum heater control connector	Plenum Heater transformer is burned out.	Voltmeter does not show 24VAC across transformer secondary winding.	Replace transformer.
	Plenum heater control board is faulty.	Transformer tested OK in previous step.	Replace control board.
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty wiring.	24VAC present across C and ground at the plenum heater, but not across ground of the plenum heater and I of the heat pump terminal strip	Correct wiring.
	Faulty wiring.	If previous step tested OK, 24VAC is present across ground of the plenum heart and 1 of the heat pump terminal strip, but not across ground of the plenum heater and 1 of the plenum heater.	Correct wiring.
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty Plenum Heater Relay in heat pump	24VAC is present across pin 1 and pin 3 of the relay, 24VAC is present from heat pump terminal strip I to plenum heater ground, but not from heat pump terminal strip 1 to plenum heater ground.	Replace relay.

PLENUM HEATER TROUBLE SHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Thermal overload is tripped.	Fan not operating	See Fan Not Operating section	Correct problem. Reset thermal overload.
	Faulty overload	Reset thermal overload	Replace if faulty.

DOMESTIC HOT WATER (DHW) TROUBLE SHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Insufficient hot water (Tank Problem)	Thermostat on hot water tank set too low. Should be set at 120°F. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)
	Breaker tripped, or fuse blown in electrical supply to hot water tank.	Check both line and load sides of fuses. If switch is open determine why.	Replace blown fuse or reset breaker.
	Reset button tripped on hot water tank.	Check voltage at elements with multimeter.	Push reset button.
Insufficient hot water (Heat Pump Problem)	Circulator pump not operating.	Visually inspect the pump to see if shaft is turning. Use an amprobe to measure current draw.	Replace if faulty.
	Blockage or restriction in the water line or hot water heat exchanger.	Check water flow and power to pump. Check water lines for obstruction	Remove obstruction in water lines. Acid treat the domestic hot water coil.
	Faulty DHW cutout (failed open).	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Heat pump not running enough hours to make sufficient hot water.	Note the amount of time the heat pump runs in any given hour.	Temporarily turn up the tank thermostats until colder weather creates longer run cycles.
Water is too hot.	Faulty DHW cutout (failed closed).	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Thermostat on hot water tank set too high. Should be set at 120°F. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)

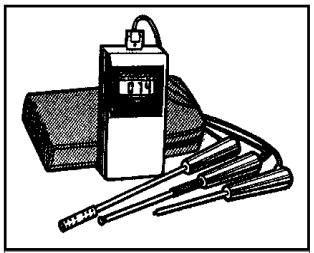


Refrigeration

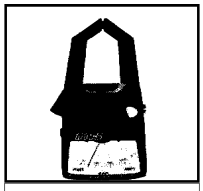


In-line Flowmeter

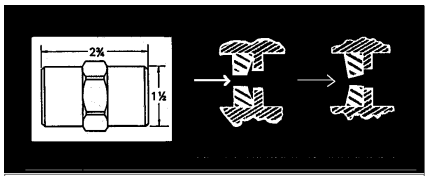
Trouble Shooting Tools



Digital



Multimeter - Voltmeter /



Dole flow control Valve

The Dole® flow control is a simple, self-cleaning device designed to deliver a constant volume of water from any outlet whether the pressure is 15 psig or as high as 125 psi. The controlling mechanism consists of a flexible orifice that varies its area inversely with pressure so that a constant flow is maintained.

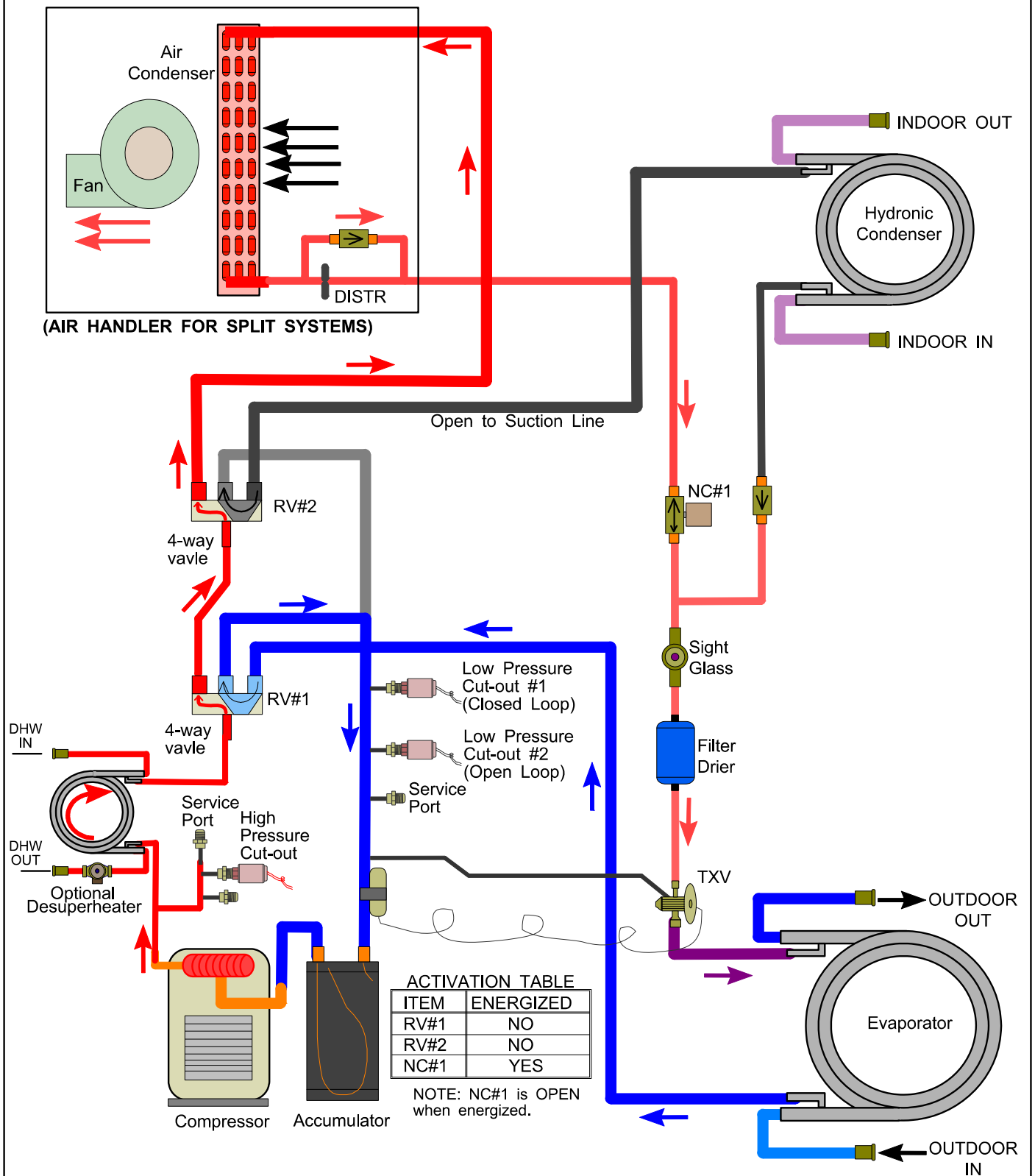
REPAIR PROCEDURES

PUMP DOWN PROCEDURE	
STEP 1	Connect the refrigerant recovery unit to the heat pump service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. **If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.**
STEP 2	All water coil heat exchangers must either have full flow or be completely drained of fluid before recovery begins. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty. (Note that this does not apply to double wall domestic hot water exchangers (desuperheater coils)
STEP 3	Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
STEP 4	Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
STEP 5	Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.
STEP 6	The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any soldering procedures to prevent soot buildup inside the pipes. Maritime Geothermal Ltd. recommends replacing the liquid line filter-drier anytime the refrigeration system has been exposed to the atmosphere.

VACUUM AND CHARGING PROCEDURE	
STEP 1	After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.
STEP 2	Release the refrigerant circuit pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
STEP 3	Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank.
STEP 4	Weigh in the appropriate amount of refrigerant through the low pressure (suction) service port. Refer to the label on the unit or the **Refrigerant Charge Chart** in the **MODEL SPECIFIC INFORMATION** section for the proper charge amount.
STEP 5	If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted.

REPLACMENT PROCEDURE FOR A COMPRESSOR BURN-OUT	
STEP 1	Pump down the unit as per the Pump Down Procedure above. Discard the refrigerant according to local codes.
STEP 2	Replace the compressor. Replace the liquid line filter-drier.
STEP 3	Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 4	Charge the unit with **NEW REFRIGERANT** and operate it for continuously for 2 hours. Pump down the unit and replace the filter-drier. Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 5	Charge the unit (refrigerant can be re-used) and operate it for 2-3 days. Perform an acid test. If it fails, pump down the unit and replace the filter-drier.
STEP 6	Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Perform and acid test, If it fails pump down the unit and replace the filter-drier.
STEP 7	Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.

TF (MOD-PAR) REFRIGERATION CIRCUIT - AIR HEATING MODE



ACTIVATION TABLE

ITEM	ENERGIZED
RV#1	NO
RV#2	NO
NC#1	YES

NOTE: NC#1 is OPEN when energized.

REV	ECO #	IMPL BY	APVD BY	DATE
04	000217	D. RHEAULT	D. RHEAULT	01 JAN 14
03	000192	D. RHEAULT	D. RHEAULT	01 JUN 12
02	000166	C. GEDDES	C. GEDDES	01 DEC 10
01	Initial Release	D. RHEAULT	D. RHEAULT	12 JAN 10

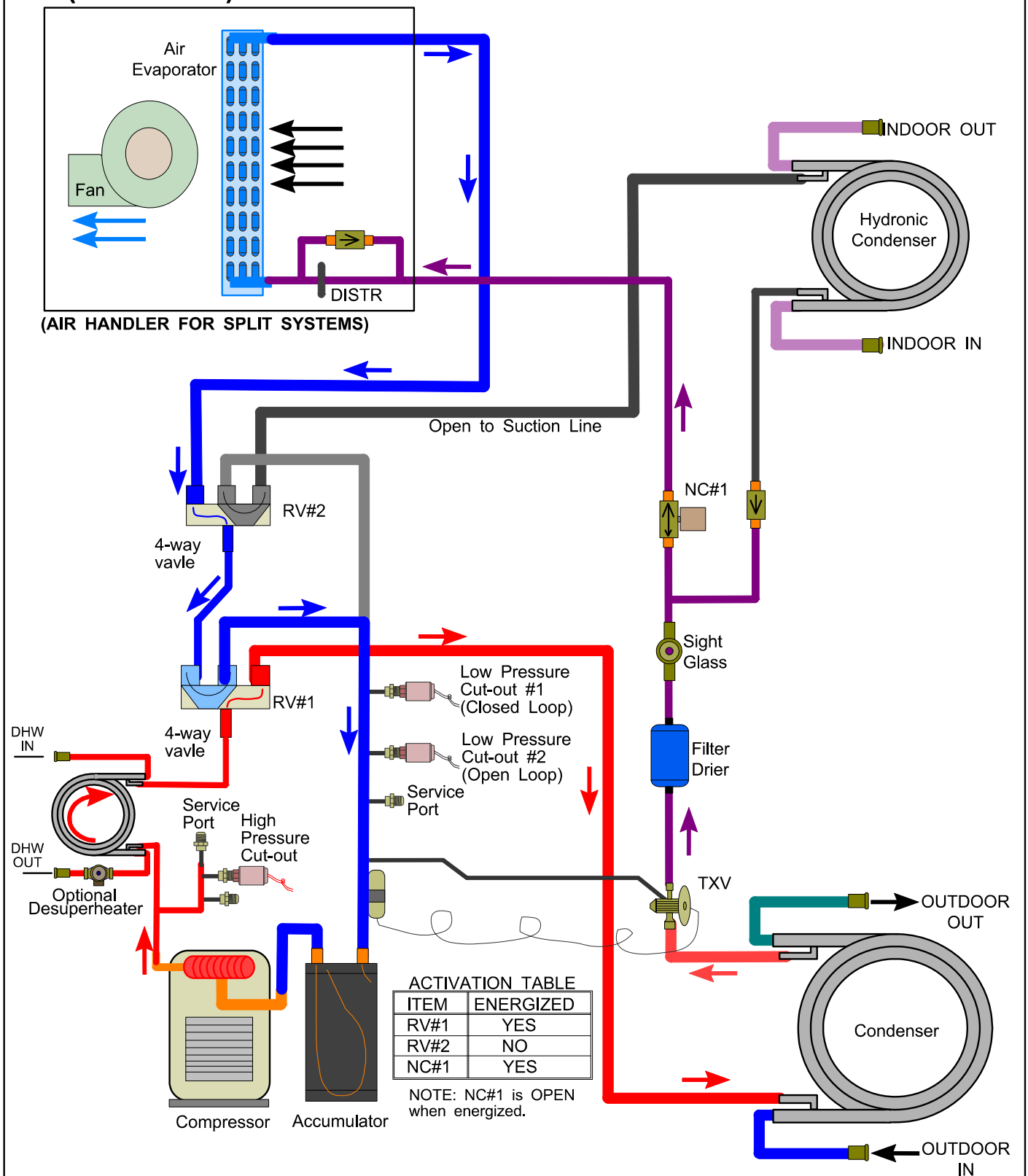
Drawn By D. RHEAULT	Date 12 JAN 10	
Checked By D. RHEAULT	Date 12 JAN 10	
Approved By (ENG) D. RHEAULT	Date 12 JAN 10	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Modular-Parallel TF Refrigeration Circuit - Air Heating Mode

Size	Drawing Number	REV	SHEET
A	001197RCD	04	1 of 1

TF (MOD-PAR) REFRIGERATION CIRCUIT - AIR COOLING MODE



ACTIVATION TABLE

ITEM	ENERGIZED
RV#1	YES
RV#2	NO
NC#1	YES

NOTE: NC#1 is OPEN when energized.

REV	ECO #	IMPL BY	APVD BY	DATE
04	000217	D. RHEAULT	D. RHEAULT	01 JAN 14
03	000192	D. RHEAULT	D. RHEAULT	01 JUN 12
02	000166	C. GEDDES	C. GEDDES	01 DEC 10
01	Initial Release	D. RHEAULT	D. RHEAULT	12 JAN 10

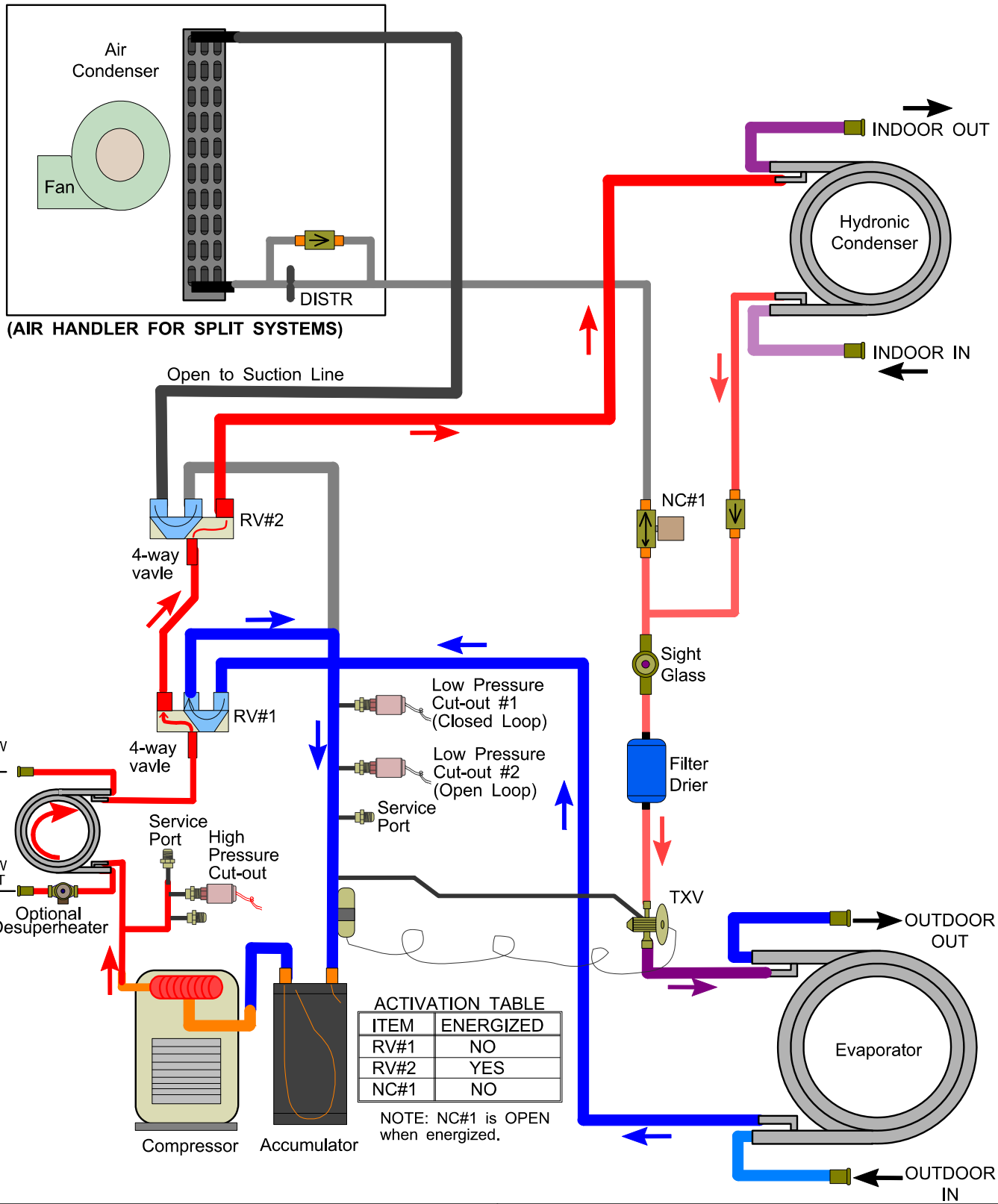
Drawn By D. RHEAULT	Date	12 JAN 10
Checked By D. RHEAULT	Date	12 JAN 10
Approved By (ENG) D. RHEAULT	Date	12 JAN 10
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Modular-Parallel TF Refrigeration Circuit - Air Cooling Mode

Size	Drawing Number	REV	SHEET
A	001198RCD	04	1 of 1

TF (MOD-PAR) REFRIGERATION CIRCUIT - HYDRONIC HEAT MODE



ACTIVATION TABLE	
ITEM	ENERGIZED
RV#1	NO
RV#2	YES
NC#1	NO

NOTE: NC#1 is OPEN when energized.

REV	ECO #	IMPL BY	APVD BY	DATE
04	000217	D. RHEAULT	D. RHEAULT	01 JAN 14
03	000192	D. RHEAULT	D. RHEAULT	01 JUN 12
02	000166	C. GEDDES	C. GEDDES	01 DEC 10
01	Initial Release	D. RHEAULT	D. RHEAULT	12 JAN 10

Drawn By D. RHEAULT	Date 12 JAN 10	
Checked By D. RHEAULT	Date 12 JAN 10	
Approved By (ENG) D. RHEAULT	Date 12 JAN 10	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Modular-Parallel TF Refrigeration Circuit - Hydronic Heating Mode

Size	Drawing Number	REV	SHEET
A	001199RCD	04	1 of 1

Model Specific Information

This section provides general information particular to each model. For complete specifications please see the specifications document for the desired model.

REFRIGERANT CHARGE CHART

Table 16 - Refrigerant - R410a

SIZE	Lbs.	kg
45	6.0	2.7
55	8.0	3.6
65	10.0	4.5
75	12.0	5.4
80	12.0	5.4
System contains POE oil.		

SHIPPING INFORMATION

Table 17 - Shipping Information

MODEL	WEIGHT	DIMENSIONS in (cm)		
SIZE	Lbs. (kg)	L	W	H
45	520 (236)	44 (112)	36 (91)	68 (173)
55	575 (261)	44 (112)	36 (91)	68 (173)
65	635 (288)	44 (112)	36 (91)	68 (173)
75	680 (308)	44 (112)	36 (91)	68 (173)
80	695 (315)	44 (112)	36 (91)	68 (173)

STANDARD CAPACITY RATINGS

The tables below depict the results of standard capacity rating tests according to C13256-1, which is identical to ISO13256-1. Stage 1 values do not apply to single stage units. Refer to the Electrical Tables to determine which models are single stage.

Table 18 - Standard Capacity Ratings - Ground Loop Heating* 60Hz

EAT 68°F (20°C) — STAGE 1 - ELT 41°F (5°C); STAGE 2 - ELT 32°F (0°C)

Model	Size	Liquid Flow			Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP_H
	Tons	IGAL	USG	L/s	PSI	kPA		CFM	L/s	Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	5.5	37.9	Stage 1	1030	486	1,550	23,600	6.9	4.47
							Stage 2	1200	566	2,290	31,700	9.4	4.06
55	4	10	12.0	0.76	5.1	35.3	Stage 1	1240	585	2,250	33,500	9.8	4.37
							Stage 2	1500	708	3,000	39,500	11.6	3.86
65	5	12	14.4	0.91	6.3	43.7	Stage 1	1540	727	2,615	39,000	11.4	4.37
							Stage 2	1900	897	3,510	47,800	14.0	3.99
75	6	14	16.8	1.06	5.9	40.8	Stage 1	1660	783	3,600	48,400	14.2	3.94
							Stage 2	2100	991	4,465	57,200	16.8	3.75
80	6	14	16.8	1.06	5.9	40.8							
							Stage 1	2400	1133	5,155	61,900	18.1	3.52

*** 15% NaCl by Weight Ground Loop Fluid**

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Table 19 - Standard Capacity Ratings - Ground Water Heating 60Hz

EAT 68°F (20°C) — ELT 50°F (10°C)

Model	Size	Liquid Flow			Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP_H
	Tons	IGAL	USG	L/s	PSI	kPA		CFM	L/s	Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	4.9	34.1	Stage 1	1030	486	1,500	26,900	7.9	5.26
							Stage 2	1200	566	2,480	40,200	11.8	4.75
55	4	10	12.0	0.76	4.6	32.1	Stage 1	1240	585	2,315	37,800	11.1	4.78
							Stage 2	1500	708	3,305	51,500	15.1	4.57
65	5	12	14.4	0.91	5.6	38.9	Stage 1	1540	727	2,645	44,100	12.9	4.89
							Stage 2	1900	897	3,790	60,400	17.7	4.67
75	6	14	16.8	1.06	5.0	34.6	Stage 1	1660	783	3,610	54,200	15.9	4.40
							Stage 2	2100	991	4,880	71,400	20.9	4.29
80	6	14	16.8	1.06	5.0	34.6							
							Stage 1	2400	1133	5,600	77,100	22.6	4.04

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Table 20 - Standard Capacity Ratings - Ground Loop Cooling* 60Hz

EAT 80.6°F (27°C) — STAGE 1 - ELT 68°F (20°C); STAGE 2 - ELT 77°F (25°C)

Model	Size	Liquid Flow			Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP_C
	Tons	IGAL	USG	L/s	PSI	kPA		CFM	L/s	Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	5.1	35.1	Stage 1	1030	486	1,060	32,600	9.6	9.04
							Stage 2	1200	566	1,965	44,100	12.9	6.57
55	4	10	12.0	0.76	4.9	33.6	Stage 1	1240	585	1,750	41,600	12.2	6.97
							Stage 2	1500	708	3,015	51,700	15.1	5.02
65	5	12	14.4	0.91	5.7	39.2	Stage 1	1540	727	2,025	49,400	14.4	7.14
							Stage 2	1900	897	3,500	60,500	17.7	5.06
75	6	14	16.8	1.06	5.6	38.8	Stage 1	1660	783	2,790	58,200	17.0	6.11
							Stage 2	2100	991	4,460	69,700	20.4	4.58
80	6	14	16.8	1.06	5.6	38.8	Stage 1	2400	1133	5,235	77,200	22.6	4.32

* 15% NaCl by Weight Ground Loop Fluid

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Table 21 - Standard Capacity Ratings - Ground Water Cooling 60Hz

EAT 80.6°F (27°C) — ELT 59°F (15°C)

Model	Size	Liquid Flow			Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP_C
	Tons	IGAL	USG	L/s	PSI	kPA		CFM	L/s	Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	5.0	34.8	Stage 1	1030	486	895	33,900	9.9	11.11
							Stage 2	1200	566	1,640	45,600	13.4	8.16
55	4	10	12.0	0.76	4.7	32.2	Stage 1	1240	585	1,525	43,300	12.7	8.31
							Stage 2	1500	708	2,515	56,000	16.4	6.52
65	5	12	14.4	0.91	5.5	38.0	Stage 1	1540	727	1,760	51,300	15.0	8.53
							Stage 2	1900	897	2,950	66,700	19.5	6.63
75	6	14	16.8	1.06	4.9	33.6	Stage 1	1660	783	2,485	61,100	17.9	7.21
							Stage 2	2100	991	3,875	76,600	22.2	5.79
80	6	14	16.8	1.06	4.9	33.6	Stage 1	2400	1133	4,350	84,100	24.6	5.66

Table 22 - Standard Capacity Ratings - Ground Loop Hydronic Heating* 60Hz

EWT 104°F (40°C) — STAGE 1 - ELT 41°F (5°C); STAGE 2 - ELT 32°F (0°C)

Model	Size	Liquid Flow (Outdoor & Indoor)			Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_H
	Tons	IGAL	USG	L/s	PSI	kPA		Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	5.5	37.9	Stage 1	1,940	21,600	6.3	3.26
							Stage 2	2,665	28,100	8.2	3.09
55	4	10	12.0	0.76	5.1	35.3	Stage 1	2,920	31,100	9.1	3.13
							Stage 2	3,950	38,300	11.2	2.85
65	5	12	14.4	0.91	6.3	43.7	Stage 1	3,340	38,200	11.2	3.35
							Stage 2	4,340	46,200	13.5	3.12
75	6	14	16.8	1.06	5.9	40.8	Stage 1	4,395	44,800	13.1	2.99
							Stage 2	5,425	51,400	15.0	2.77
80	6	14	16.8	1.06	5.9	40.8	Stage 1	6,490	56,600	16.6	2.83

* 15% NaCl by Weight Ground Loop Fluid

REV-11

Table 23 - Standard Capacity Ratings - Ground Water Hydronic Heating 60Hz

EWT 104°F (40°C) — ELT 50°F (10°C)

Model	Size	Liquid Flow (Outdoor & Indoor)			Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_H
	Tons	IGAL	USG	L/s	PSI	kPA		Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	4.9	34.1	Stage 1	1,840	25,700	7.5	4.09
							Stage 2	2,595	36,600	10.7	4.13
55	4	10	12.0	0.76	4.6	32.1	Stage 1	2,860	35,700	10.5	3.66
							Stage 2	3,910	48,800	14.3	3.65
65	5	12	14.4	0.91	5.6	38.9	Stage 1	3,305	43,900	12.9	3.89
							Stage 2	4,365	59,100	17.3	3.97
75	6	14	16.8	1.06	5.0	34.6	Stage 1	4,335	51,700	15.2	3.50
							Stage 2	5,565	67,700	19.8	3.57
80	6	14	16.8	1.06	5.0	34.6	Stage 1	6,245	73,300	21.5	3.44

CAPACITY RATINGS

Heating Mode

TF-45-HACW-P-1T — **Nominal 3 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan*	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	°F	°F	CFM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts						°C	°C	L/s	°C	°C	Watts
25.0	20	9.6	20.2	4.8	21,781	2,031	8.9	217	2,236	**3.82**	68	100	1,200	92.3	24.3	**29,128**
-3.9	-6.7	0.606	-6.5	2.7	6,382						20.0	37.8	566	33.5	13.5	**8,534**
31.0	25	9.6	25.8	5.2	23,701	2,088	9.1	217	2,293	**3.99**	68	102	1,200	94.0	26.0	**31,242**
-0.6	-3.9	0.606	-3.4	2.9	6,944						20.0	38.9	566	34.5	14.5	**9,154**
37.0	30	9.6	31.4	5.6	25,756	2,145	9.4	217	2,350	**4.18**	68	104	1,200	95.9	27.9	**33,493**
2.8	-1.1	0.606	-0.4	3.1	7,546						20.0	40.0	566	35.5	15.5	**9,813**
43.0	35	9.6	36.9	6.1	27,903	2,194	9.5	217	2,399	**4.37**	68	105	1,200	97.8	29.8	**35,806**
6.1	1.7	0.606	2.7	3.4	8,175						20.0	40.6	566	36.6	16.6	**10,491**
45.0	40	9.6	38.7	6.3	29,994	2,272	9.8	217	2,421	**4.62**	68	107	1,200	99.5	31.5	**38,152**
7.2	4.4	0.606	3.7	3.5	8,788						20.0	41.7	566	37.5	17.5	**11,179**
51.0	45	9.6	44.2	6.8	32,454	2,334	10.1	217	2,483	**4.82**	68	109	1,200	101.7	33.7	**40,822**
10.6	7.2	0.606	6.8	3.8	9,509						20.0	42.8	566	38.7	18.7	**11,961**
57.0	50	9.6	49.7	7.3	35,062	2,397	10.4	217	2,546	**5.02**	68	111	1,200	104.0	36.0	**43,647**
13.9	10.0	0.606	9.8	4.1	10,273						20.0	43.9	566	40.0	20.0	**12,788**
63.0	55	9.6	55.1	7.9	37,821	2,463	10.7	217	2,612	**5.23**	68	113	1,200	106.5	38.5	**46,631**
17.2	12.8	0.606	12.8	4.4	11,082						20.0	45.0	566	41.4	21.4	**13,663**

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

Cooling Mode

TF-45-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)								Power Consumption					Sink Data (Outdoor Loop)					
EAT	Evap. Temp	Airflow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts					COPc	°C	°C	L/min	°C	°C	Watts
80.6	44.3	1,200	57.3	23.3	15,569	29,862	**45,431**	1,433	5.5	207	1,586	**28.6**	57	65	9.6	67.6	10.6	51,026
27.0	6.8	566	14.0	13.0	4,562	8,749	**13,311**					**8.39**	13.9	18.3	0.606	19.8	5.9	14,951
80.6	45	1,200	57.5	23.1	15,422	29,579	**45,001**	1,563	6.0	207	1,717	**26.2**	62	70	9.6	72.6	10.6	51,042
27.0	7.2	566	14.2	12.8	4,519	8,667	**13,185**					**7.68**	16.7	21.1	0.606	22.6	5.9	14,955
80.6	45.7	1,200	57.7	22.9	15,262	29,273	**44,535**	1,694	6.4	207	1,847	**24.1**	67	75	9.6	77.6	10.6	51,023
27.0	7.6	566	14.3	12.7	4,472	8,577	**13,049**					**7.06**	19.4	23.9	0.606	25.4	5.9	14,950
80.6	46.3	1,200	57.9	22.7	15,148	29,053	**44,201**	1,753	6.9	207	1,906	**23.2**	72	80	9.6	82.6	10.6	50,889
27.0	7.9	566	14.4	12.6	4,438	8,513	**12,951**					**6.79**	22.2	26.7	0.606	28.1	5.9	14,910
80.6	47	1,200	57.4	23.2	14,236	29,662	**43,898**	1,803	7.4	207	1,992	**22.0**	78	85	9.6	89.1	11.1	50,760
27.0	8.3	566	14.1	12.9	4,171	8,691	**12,862**					**6.46**	25.6	29.4	0.606	31.7	6.2	14,872
80.6	48	1,200	57.7	22.9	14,046	29,265	**43,310**	1,932	7.9	207	2,121	**20.4**	83	90	9.6	94.1	11.1	50,609
27.0	8.7	566	14.3	12.7	4,115	8,575	**12,690**					**5.98**	28.3	32.2	0.606	34.5	6.2	14,828
80.6	48	1,200	58.0	22.6	13,841	28,840	**42,681**	2,065	8.5	207	2,254	**18.9**	88	95	9.6	99.1	11.1	50,434
27.0	9.1	566	14.5	12.5	4,056	8,450	**12,505**					**5.55**	31.1	35.0	0.606	37.3	6.1	14,777
80.6	49	1,200	58.4	22.2	13,623	28,385	**42,009**	2,204	9.0	207	2,393	**17.6**	93	100	9.6	104.0	11.0	50,237
27.0	9.5	566	14.7	12.3	3,992	8,317	**12,308**					**5.14**	33.9	37.8	0.606	40.0	6.1	14,719

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

CAPACITY RATINGS (continued)

Heating Mode

TF-55-HACW-P-1T — **Nominal 4 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan*	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	°F	°F	CFM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts						°C	°C	L/s	°C	°C	Watts
26.0	15	12.0	21.3	4.7	27,057	2,705	10.9	184	2,839	**3.77**	68	91	1,500	92.3	24.3	**36,516**
-3.3	-9.4	0.757	-6.0	2.6	7,928						20.0	32.8	708	33.5	13.5	**10,699**
32.0	20	12.0	26.8	5.2	29,480	2,875	11.6	184	3,008	**3.85**	68	96	1,500	94.3	26.3	**39,518**
0.0	-6.7	0.757	-2.9	2.9	8,638						20.0	35.6	708	34.6	14.6	**11,579**
38.0	25	12.0	32.4	5.6	31,996	3,051	12.3	184	3,184	**3.92**	68	101	1,500	96.4	28.4	**42,634**
3.3	-3.9	0.757	0.2	3.1	9,375						20.0	38.3	708	35.8	15.8	**12,492**
44.0	30	12.0	37.8	6.2	35,339	3,178	13.7	184	3,312	**4.11**	68	110	1,500	98.9	30.9	**46,412**
6.7	-1.1	0.757	3.2	3.4	10,354						20.0	43.3	708	37.2	17.2	**13,599**
49.0	35	12.0	42.4	6.6	39,564	3,185	14.7	184	3,314	**4.48**	68	116	1,500	101.8	33.8	**50,663**
9.4	1.7	0.757	5.8	3.7	11,592						20.0	46.7	708	38.8	18.8	**14,844**
55.0	40	12.0	47.9	7.1	42,408	3,375	15.6	184	3,504	**4.53**	68	121	1,500	104.1	36.1	**54,154**
12.8	4.4	0.757	8.8	3.9	12,425						20.0	49.4	708	40.1	20.1	**15,867**
61.0	45	12.0	53.4	7.6	45,485	3,556	16.4	184	3,685	**4.60**	68	125.5	1,500	106.6	38.6	**57,849**
16.1	7.2	0.757	11.9	4.2	13,327						20.0	51.9	708	41.4	21.4	**16,950**
67.0	50	12.0	58.9	8.1	48,432	3,769	17.4	184	3,898	**4.62**	68	130.5	1,500	109.0	41.0	**61,523**
19.4	10.0	0.757	15.0	4.5	14,190						20.0	54.7	708	42.8	22.8	**18,026**

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

Cooling Mode

TF-55-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)								Power Consumption					Sink Data (Outdoor Loop)					
EAT	Evap. Temp	Airflow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts					COPc	°C	°C	L/s	°C	°C	Watts
80.6	46	1,500	55.6	25.0	19,259	39,728	**58,987**	2,069	9.2	181	2,197	**26.8**	48	75	12.0	59.1	11.1	66,666
27.0	7.8	708	13.1	13.9	5,643	11,640	**17,283**					**7.87**	8.9	23.9	0.757	15.1	6.2	19,533
80.6	46	1,500	56.2	24.4	18,819	38,819	**57,637**	2,211	9.8	181	2,339	**24.6**	53	80	12.0	64.0	11.0	65,800
27.0	7.8	708	13.4	13.6	5,514	11,374	**16,888**					**7.22**	11.7	26.7	0.757	17.8	6.1	19,279
80.6	46	1,500	56.8	23.8	18,366	37,886	**56,252**	2,355	10.4	181	2,484	**22.6**	58	85	12.0	68.8	10.8	64,907
27.0	7.8	708	13.8	13.2	5,381	11,100	**16,482**					**6.64**	14.4	29.4	0.757	20.5	6.0	19,018
80.6	47	1,500	57.8	22.8	17,583	36,271	**53,854**	2,623	11.0	181	2,751	**19.6**	63	90	12.0	73.6	10.6	63,423
27.0	8.3	708	14.3	12.7	5,152	10,627	**15,779**					**5.74**	17.2	32.2	0.757	23.1	5.9	18,583
80.6	48	1,500	58.3	22.3	16,209	35,198	**51,407**	2,909	11.7	181	3,045	**16.9**	78	95	12.0	88.9	10.9	61,955
27.0	8.9	708	14.6	12.4	4,749	10,313	**15,062**					**4.95**	25.6	35.0	0.757	31.6	6.0	18,153
80.6	48	1,500	58.9	21.7	15,755	34,214	**49,970**	3,083	12.3	181	3,219	**15.5**	83	100	12.0	93.7	10.7	61,110
27.0	8.9	708	14.9	12.1	4,616	10,025	**14,641**					**4.55**	28.3	37.8	0.757	34.3	6.0	17,905
80.6	48	1,500	59.5	21.1	15,290	33,203	**48,493**	3,265	13.0	181	3,401	**14.3**	88	105	12.0	98.6	10.6	60,253
27.0	8.9	708	15.3	11.7	4,480	9,728	**14,208**					**4.18**	31.1	40.6	0.757	37.0	5.9	17,654
80.6	48	1,500	60.2	20.4	14,811	32,164	**46,975**	3,455	13.8	181	3,591	**13.1**	93	110	12.0	103.4	10.4	59,386
27.0	8.9	708	15.7	11.3	4,340	9,424	**13,764**					**3.83**	33.9	43.3	0.757	39.7	5.8	17,400

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

CAPACITY RATINGS (continued)

Heating Mode

TF-65-HACW-P-1T — **Nominal 5 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan*	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	°F	°F	CFM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts						°C	°C	L/s	°C	°C	Watts
26.0	15	14.4	21.2	4.8	32,776	3,241	14.7	255	3,417	**3.79**	68	96	1,900	91.3	23.3	**44,189**
-3.3	-9.4	0.908	-6.0	2.7	9,603						20.0	35.6	897	32.9	12.9	**12,947**
32.0	20	14.4	26.7	5.3	36,044	3,334	15.1	255	3,510	**3.99**	68	98	1,900	93.1	25.1	**47,774**
0.0	-6.7	0.908	-2.9	2.9	10,561						20.0	36.7	897	34.0	14.0	**13,998**
38.0	25	14.4	32.2	5.8	39,557	3,427	15.5	255	3,603	**4.20**	68	100	1,900	95.2	27.2	**51,605**
3.3	-3.9	0.908	0.1	3.2	11,590						20.0	37.8	897	35.1	15.1	**15,120**
44.0	30	14.4	37.7	6.3	43,192	3,498	15.9	255	3,674	**4.42**	68	102	1,900	97.2	29.2	**55,483**
6.7	-1.1	0.908	3.2	3.5	12,655						20.0	38.9	897	36.2	16.2	**16,256**
49.0	35	14.4	42.5	6.5	46,773	3,615	16.5	255	3,793	**4.59**	68	105	1,900	99.3	31.3	**59,474**
9.4	1.7	0.908	5.8	3.6	13,704						20.0	40.6	897	37.4	17.4	**17,426**
55.0	40	14.4	47.9	7.1	51,013	3,711	17.0	255	3,889	**4.82**	68	107	1,900	101.7	33.7	**64,043**
12.8	4.4	0.908	8.8	3.9	14,947						20.0	41.7	897	38.7	18.7	**18,765**
61.0	45	14.4	53.3	7.7	55,525	3,810	17.4	255	3,988	**5.06**	68	109	1,900	104.3	36.3	**68,892**
16.1	7.2	0.908	11.8	4.3	16,269						20.0	42.8	897	40.1	20.1	**20,185**
67.0	50	14.4	58.6	8.4	60,315	3,912	17.9	255	4,090	**5.30**	68	111	1,900	107.0	39.0	**74,031**
19.4	10.0	0.908	14.8	4.7	17,672						20.0	43.9	897	41.6	21.6	**21,691**

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

Cooling Mode

TF-65-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)								Power Consumption					Sink Data (Outdoor Loop)					
EAT	Evap. Temp	Airflow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts					COPc	°C	°C	L/s	°C	°C	Watts
80.6	43.7	1,900	57.1	23.5	20,947	46,843	**67,790**	2,556	11.6	260	2,748	**24.7**	53	75	14.4	63.8	10.8	77,402
27.0	6.5	897	14.0	13.0	6,137	13,725	**19,862**					**7.23**	11.7	23.9	0.908	17.6	6.0	22,679
80.6	44	1,900	57.5	23.1	20,603	46,072	**66,675**	2,759	12.3	260	2,950	**22.6**	58	80	14.4	68.7	10.7	76,977
27.0	6.7	897	14.2	12.8	6,036	13,499	**19,536**					**6.62**	14.4	26.7	0.908	20.4	5.9	22,554
80.6	44.3	1,900	57.9	22.7	20,241	45,264	**65,505**	2,964	13.1	260	3,156	**20.8**	63	85	14.4	73.6	10.6	76,510
27.0	6.8	897	14.4	12.6	5,931	13,262	**19,193**					**6.08**	17.2	29.4	0.908	23.1	5.9	22,417
80.6	44.6	1,900	58.7	21.9	19,508	43,624	**63,132**	3,100	14.0	260	3,292	**19.2**	68	90	14.4	78.4	10.4	74,600
27.0	7.0	897	14.9	12.1	5,716	12,782	**18,497**					**5.62**	20.0	32.2	0.908	25.8	5.8	21,858
80.6	45	1,900	59.5	21.1	19,173	41,694	**60,868**	3,233	14.8	260	3,391	**17.9**	76	95	14.4	86.6	10.6	72,788
27.0	7.2	897	15.3	11.7	5,618	12,216	**17,834**					**5.26**	24.4	35.0	0.908	30.4	5.9	21,327
80.6	45	1,900	60.0	20.6	18,764	40,804	**59,568**	3,449	15.7	260	3,607	**16.5**	81	100	14.4	91.6	10.6	72,226
27.0	7.4	897	15.5	11.5	5,498	11,956	**17,453**					**4.84**	27.2	37.8	0.908	33.1	5.9	21,162
80.6	46	1,900	60.4	20.2	18,336	39,872	**58,208**	3,675	16.6	260	3,833	**15.2**	86	105	14.4	96.5	10.5	71,637
27.0	7.6	897	15.8	11.2	5,372	11,683	**17,055**					**4.45**	30.0	40.6	0.908	35.8	5.8	20,989
80.6	46	1,900	60.9	19.7	17,887	38,898	**56,785**	3,912	17.6	260	4,070	**14.0**	91	110	14.4	101.4	10.4	71,023
27.0	7.7	897	16.1	10.9	5,241	11,397	**16,638**					**4.09**	32.8	43.3	0.908	38.5	5.8	20,810

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

CAPACITY RATINGS (continued)

Heating Mode

TF-75-HACW-P-1T — **Nominal 6 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan*	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	°F	°F	CFM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts						°C	°C	L/s	°C	°C	Watts
27.0	15	16.8	22.1	4.9	39,359	4,016	18.8	370	4,375	**3.60**	68	104	2,100	93.6	25.6	**53,818**
-2.8	-9.4	1.060	-5.5	2.7	11,532						20.0	40.0	991	34.2	14.2	**15,768**
33.0	20	16.8	27.6	5.4	43,335	4,116	19.3	370	4,475	**3.81**	68	106	2,100	95.7	27.7	**58,135**
0.6	-6.7	1.060	-2.5	3.0	12,697						20.0	41.1	991	35.4	15.4	**17,033**
39.0	25	16.8	33.0	6.0	47,606	4,216	19.8	370	4,575	**4.02**	68	108	2,100	97.9	29.9	**62,747**
3.9	-3.9	1.060	0.6	3.3	13,949						20.0	42.2	991	36.6	16.6	**18,385**
45.0	30	16.8	38.5	6.5	51,487	4,355	20.3	370	4,713	**4.17**	68	110	2,100	100.0	32.0	**67,102**
7.2	-1.1	1.060	3.6	3.6	15,086						20.0	43.3	991	37.8	17.8	**19,661**
50.0	35	16.8	43.4	6.6	55,170	4,546	21.0	370	4,873	**4.29**	68	113	2,100	102.0	34.0	**71,398**
10.0	1.7	1.060	6.3	3.7	16,165						20.0	45.0	991	38.9	18.9	**20,919**
56.0	40	16.8	48.9	7.1	59,792	4,704	21.7	370	5,031	**4.46**	68	116	2,100	104.5	36.5	**76,559**
13.3	4.4	1.060	9.4	4.0	17,519						20.0	46.7	991	40.3	20.3	**22,432**
62.0	45	16.8	54.3	7.7	64,657	4,868	22.5	370	5,194	**4.62**	68	119	2,100	107.0	39.0	**81,982**
16.7	7.2	1.060	12.4	4.3	18,944						20.0	48.3	991	41.7	21.7	**24,021**
68.0	50	16.8	59.7	8.3	69,767	5,038	23.3	370	5,365	**4.79**	68	122	2,100	109.7	41.7	**87,674**
20.0	10.0	1.060	15.4	4.6	20,442						20.0	50.0	991	43.2	23.2	**25,688**

Compressor: ZPS60K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

Cooling Mode

TF-75-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)								Power Consumption					Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Airflow	LLT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Effective	Effi-ciency	EAT	Cond. Temp.	Flow	LAT	Delta T	Rejection
°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts					COPc	°C	°C	L/s	°C	°C	Watts
80.6	43.9	2,100	56.8	23.8	27,790	52,066	**79,856**	3,092	13.9	405	3,461	**23.1**	49	75	16.8	59.9	10.9	91,790
27.0	6.6	991	13.8	13.2	8,142	15,255	**23,398**					**6.76**	9.4	23.9	1.060	15.5	6.1	26,894
80.6	44	2,100	57.2	23.4	27,226	51,010	**78,236**	3,294	14.7	405	3,663	**21.4**	54	80	16.8	64.8	10.8	90,860
27.0	6.7	991	14.0	13.0	7,977	14,946	**22,923**					**6.26**	12.2	26.7	1.060	18.2	6.0	26,622
80.6	44.1	2,100	57.7	22.9	26,643	49,918	**76,562**	3,500	15.6	405	3,869	**19.8**	59	85	16.8	69.7	10.7	89,889
27.0	6.7	991	14.3	12.7	7,806	14,626	**22,432**					**5.80**	15.0	29.4	1.060	20.9	5.9	26,337
80.6	44.2	2,100	58.4	22.2	25,896	48,519	**74,415**	3,639	16.5	405	4,008	**18.6**	64	90	16.8	74.5	10.5	88,217
27.0	6.8	991	14.7	12.3	7,588	14,216	**21,803**					**5.44**	17.8	32.2	1.060	23.6	5.8	25,847
80.6	44	2,100	58.6	22.0	24,204	48,046	**72,250**	3,776	17.4	405	4,152	**17.4**	70	95	16.8	80.8	10.8	86,521
27.0	6.8	991	14.8	12.2	7,092	14,077	**21,169**					**5.10**	21.1	35.0	1.060	27.1	6.0	25,351
80.6	44	2,100	59.2	21.4	23,591	46,831	**70,422**	3,995	18.3	405	4,371	**16.1**	75	100	16.8	85.7	10.7	85,438
27.0	6.9	991	15.1	11.9	6,912	13,721	**20,633**					**4.72**	23.9	37.8	1.060	29.8	5.9	25,033
80.6	45	2,100	59.7	20.9	22,958	45,574	**68,532**	4,223	19.3	405	4,599	**14.9**	80	105	16.8	90.6	10.6	84,327
27.0	6.9	991	15.4	11.6	6,727	13,353	**20,080**					**4.37**	26.7	40.6	1.060	32.5	5.9	24,708
80.6	45	2,100	60.3	20.3	22,304	44,274	**66,578**	4,463	20.4	405	4,839	**13.8**	85	110	16.8	95.4	10.4	83,191
27.0	7.0	991	15.7	11.3	6,535	12,972	**19,507**					**4.03**	29.4	43.3	1.060	35.2	5.8	24,375

Compressor: ZPS60K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

CAPACITY RATINGS (continued)

Heating Mode

TF-80-HACW-P-*S — **Nominal 6 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan*	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	°F	°F	CFM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts		***				°C	°C	L/s	°C	°C	Watts
27.0	15	16.8	21.9	5.1	40,836	4,511	25.1	560	5,060	**3.34**	68	104	2,400	92.0	24.0	**57,634**
-2.8	-9.4	1.1	-5.6	2.8	11,965		14.8				20.0	40.0	1,133	33.3	13.3	**16,887**
33.0	20	16.8	27.2	5.8	45,990	4,597	25.5	560	5,145	**3.59**	68	106	2,400	94.3	26.3	**63,078**
0.6	-6.7	1.1	-2.6	3.2	13,475		15.0				20.0	41.1	1,133	34.6	14.6	**18,482**
39.0	25	16.8	32.6	6.4	51,427	4,681	25.9	560	5,230	**3.85**	68	108	2,400	96.7	28.7	**68,805**
3.9	-3.9	1.1	0.3	3.6	15,068		15.2				20.0	42.2	1,133	35.9	15.9	**20,160**
45.0	30	16.8	38.1	6.9	55,197	4,847	26.3	560	5,395	**3.97**	68	110	2,400	98.5	30.5	**73,139**
7.2	-1.1	1.1	3.4	3.8	16,173		15.4				20.0	43.3	1,133	36.9	16.9	**21,430**
50.0	35	16.8	43.0	7.0	58,405	5,082	26.9	560	5,598	**4.04**	68	113	2,400	100.1	32.1	**77,109**
10.0	1.7	1.1	6.1	3.9	17,113		15.7				20.0	45.0	1,133	37.8	17.8	**22,593**
56.0	40	16.8	48.4	7.6	63,866	5,237	27.6	560	5,754	**4.23**	68	116	2,400	102.6	34.6	**83,100**
13.3	4.4	1.1	9.1	4.2	18,712		16.1				20.0	46.7	1,133	39.2	19.2	**24,348**
62.0	45	16.8	53.7	8.3	69,610	5,395	28.3	560	5,911	**4.43**	68	119	2,400	105.2	37.2	**89,383**
16.7	7.2	1.1	12.1	4.6	20,395		16.4				20.0	48.3	1,133	40.7	20.7	**26,189**
68.0	50	16.8	59.0	9.0	75,652	5,556	29.0	560	6,072	**4.63**	68	122	2,400	108.0	40.0	**95,973**
20.0	10.0	1.1	15.0	5.0	22,166		16.8				20.0	50.0	1,133	42.2	22.2	**28,120**

Compressor: ZP70KWE — *** 230-1-60 208-3-60 — * @ 49.7Pa (0.02inH2o) Ext. Static

Cooling Mode

TF-80-HACW-P-*S — **R410a 60 Hz**

Source Data (Indoor Loop)								Power Consumption					Sink Data (Outdoor Loop)					
EAT	Evap. Temp	Airflow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts		***			COPc	°C	°C	L/min	°C	°C	Watts
80.6	44	2,400	57.8	22.8	30,398	56,952	**87,349**	3,293	17.6	625	3,882	**22.5**	49	75	16.8	61.0	12.0	100,720
27.0	6.6	1,133	14.3	12.7	8,906	16,687	**25,593**		11.9			**6.59**	9.4	23.9	1.060	16.1	6.7	29,511
80.6	44	2,400	58.2	22.4	29,846	55,919	**85,765**	3,522	18.5	625	4,112	**20.9**	54	80	16.8	65.9	11.9	99,920
27.0	6.7	1,133	14.6	12.4	8,745	16,384	**25,129**		12.3			**6.11**	12.2	26.7	1.060	18.8	6.6	29,276
80.6	44	2,400	58.6	22.0	29,251	54,804	**84,055**	3,761	19.5	625	4,350	**19.3**	59	85	16.8	70.8	11.8	99,026
27.0	6.7	1,133	14.8	12.2	8,571	16,057	**24,628**		12.6			**5.66**	15.0	29.4	1.060	21.6	6.6	29,014
80.6	44	2,400	59.1	21.5	28,612	53,607	**82,219**	3,992	20.6	625	4,581	**17.9**	64	90	16.8	75.7	11.7	97,977
27.0	6.8	1,133	15.1	11.9	8,383	15,707	**24,090**		13.1			**5.26**	17.8	32.2	1.060	24.3	6.5	28,707
80.6	44	2,400	59.2	21.4	26,892	53,382	**80,273**	4,235	21.7	625	4,831	**16.6**	70	95	16.8	82.1	12.1	96,861
27.0	6.8	1,133	15.1	11.9	7,879	15,641	**23,520**		13.5			**4.87**	21.1	35.0	1.060	27.9	6.7	28,380
80.6	44	2,400	59.8	20.8	26,191	51,990	**78,181**	4,518	22.9	625	5,114	**15.3**	75	100	16.8	87.0	12.0	95,733
27.0	6.9	1,133	15.4	11.6	7,674	15,233	**22,907**		14.0			**4.48**	23.9	37.8	1.060	30.6	6.7	28,050
80.6	45	2,400	60.4	20.2	25,446	50,513	**75,959**	4,822	24.1	625	5,418	**14.0**	80	105	16.8	91.8	11.8	94,550
27.0	6.9	1,133	15.8	11.2	7,456	14,800	**22,256**		14.6			**4.11**	26.7	40.6	1.060	33.2	6.6	27,703
80.6	45	2,400	61.0	19.6	24,658	48,949	**73,607**	5,151	25.5	625	5,747	**12.8**	85	110	16.8	96.7	11.7	93,322
27.0	7.0	1,133	16.1	10.9	7,225	14,342	**21,567**		15.2			**3.75**	29.4	43.3	1.060	35.9	6.5	27,343

Compressor: ZP70KWE — *** 230-1-60 208-3-60 — * @ 49.7Pa (0.02inH2o) Ext. Static

HYDRONIC CAPACITY RATINGS

Heating Mode

TF-45-HACW-P-1T — **Nominal 3 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	W/W	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
24.0	15	9.6	20.3	3.7	16,877	2,497	10.7	2,620	**2.86**	104.0	115	9.6	109.3	5.3	**25,547**
-4.4	-9.4	0.606	-6.5	2.1	4,945					40.0	46.1	0.606	43.0	3.0	**7,485**
30.0	20	9.6	25.9	4.1	18,504	2,538	10.9	2,661	**3.01**	104.0	116	9.6	109.7	5.7	**27,313**
-1.1	-6.7	0.606	-3.4	2.3	5,422					40.0	46.7	0.606	43.2	3.2	**8,003**
36.0	25	9.6	31.5	4.5	20,415	2,545	10.9	2,668	**3.21**	104.0	116	9.6	110.1	6.1	**29,247**
2.2	-3.9	0.606	-0.3	2.5	5,981					40.0	46.7	0.606	43.4	3.4	**8,569**
42.0	30	9.6	37.0	5.0	22,990	2,533	11.1	2,656	**3.51**	104.0	117	9.6	110.6	6.6	**31,782**
5.6	-1.1	0.606	2.8	2.8	6,736					40.0	47.2	0.606	43.7	3.7	**9,312**
45.0	35	9.6	39.3	5.7	25,833	2,520	11.3	2,596	**3.90**	104.0	118	9.6	111.2	7.2	**34,580**
7.2	1.7	0.606	4.1	3.1	7,569					40.0	47.8	0.606	44.0	4.0	**10,132**
51.0	40	9.6	44.8	6.2	28,381	2,523	11.3	2,599	**4.19**	104.0	118	9.6	111.7	7.7	**37,139**
10.6	4.4	0.606	7.1	3.5	8,316					40.0	47.8	0.606	44.3	4.3	**10,882**
57.0	45	9.6	50.2	6.8	30,910	2,558	11.5	2,634	**4.43**	104.0	119	9.6	112.3	8.3	**39,789**
13.9	7.2	0.606	10.1	3.8	9,057					40.0	48.3	0.606	44.6	4.6	**11,658**
63.0	50	9.6	55.6	7.4	33,856	2,562	11.5	2,638	**4.75**	104.0	119	9.6	112.9	8.9	**42,746**
17.2	10.0	0.606	13.1	4.1	9,920					40.0	48.3	0.606	45.0	5.0	**12,524**

Compressor: ZPS30K4E-PFV

Heating Mode

TF-55-HACW-P-1T — **Nominal 4 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	W/W	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
24.0	15	12.0	20.3	3.7	21,143	3,760	16.7	3,884	**2.58**	104.0	129	12.0	109.7	5.7	**34,152**
-4.4	-9.4	0.757	-6.5	2.1	6,195					40.0	53.9	0.757	43.2	3.2	**10,006**
30.0	20	12.0	25.8	4.2	23,823	3,819	17.0	3,943	**2.75**	104.0	130	12.0	110.2	6.2	**37,033**
-1.1	-6.7	0.757	-3.4	2.3	6,980					40.0	54.4	0.757	43.4	3.4	**10,850**
36.0	25	12.0	31.3	4.7	27,005	3,832	17.1	3,955	**2.98**	104.0	130	12.0	110.7	6.7	**40,259**
2.2	-3.9	0.757	-0.4	2.6	7,912					40.0	54.4	0.757	43.7	3.7	**11,796**
42.0	30	12.0	36.7	5.3	30,068	3,814	17.2	3,938	**3.22**	104.0	130	12.0	111.2	7.2	**43,263**
5.6	-1.1	0.757	2.6	2.9	8,810					40.0	54.4	0.757	44.0	4.0	**12,676**
46.0	35	12.0	40.2	5.8	33,327	3,795	17.2	3,908	**3.48**	104.0	130	12.0	111.7	7.7	**46,447**
7.8	1.7	0.757	4.5	3.2	9,765					40.0	54.4	0.757	44.3	4.3	**13,609**
52.0	40	12.0	45.5	6.5	37,284	3,800	17.3	3,914	**3.77**	104.0	130	12.0	112.4	8.4	**50,424**
11.1	4.4	0.757	7.5	3.6	10,924					40.0	54.4	0.757	44.7	4.7	**14,774**
58.0	45	12.0	50.8	7.2	41,193	3,849	17.5	3,963	**4.03**	104.0	131	12.0	113.1	9.1	**54,499**
14.4	7.2	0.757	10.4	4.0	12,070					40.0	55.0	0.757	45.1	5.1	**15,968**
64.0	50	12.0	56.0	8.0	45,776	3,854	17.5	3,967	**4.36**	104.0	131	12.0	113.9	9.9	**59,098**
17.8	10.0	0.757	13.3	4.5	13,412					40.0	55.0	0.757	45.5	5.5	**17,316**

Compressor: ZPS40K4E-PFV

Heating Mode

TF-65-HACW-P-1T — **Nominal 5 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	W/W	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
26.0	15	14.4	21.9	4.1	28,283	4,171	18.5	4,321	**2.90**	104.0	116	14.4	110.0	6.0	**42,815**
-3.3	-9.4	0.908	-5.6	2.3	8,287					40.0	46.7	0.908	43.3	3.3	**12,545**
32.0	20	14.4	27.4	4.6	31,592	4,187	18.6	4,338	**3.12**	104.0	116	14.4	110.4	6.4	**46,179**
0.0	-6.7	0.908	-2.6	2.6	9,256					40.0	46.7	0.908	43.6	3.6	**13,530**
38.0	25	14.4	32.9	5.1	35,196	4,199	18.7	4,349	**3.36**	104.0	116	14.4	110.9	6.9	**49,823**
3.3	-3.9	0.908	0.5	2.9	10,312					40.0	46.7	0.908	43.8	3.8	**14,598**
44.0	30	14.4	38.3	5.7	38,689	4,222	18.9	4,373	**3.58**	104.0	117	14.4	111.4	7.4	**53,396**
6.7	-1.1	0.908	3.5	3.1	11,336					40.0	47.2	0.908	44.1	4.1	**15,645**
48.0	35	14.4	41.8	6.2	42,747	4,191	19.0	4,365	**3.85**	104.0	117	14.4	112.0	8.0	**57,344**
8.9	1.7	0.908	5.4	3.5	12,525					40.0	47.2	0.908	44.4	4.4	**16,802**
54.0	40	14.4	47.1	6.9	46,946	4,249	19.3	4,423	**4.09**	105.0	118	14.4	113.6	8.6	**61,739**
12.2	4.4	0.908	8.4	3.8	13,755					40.6	47.8	0.908	45.3	4.8	**18,090**
60.0	45	14.4	52.4	7.6	51,814	4,254	19.3	4,429	**4.41**	104.0	118	14.4	113.3	9.3	**66,627**
15.6	7.2	0.908	11.3	4.2	15,181					40.0	47.8	0.908	45.1	5.1	**19,521**
66.0	50	14.4	57.7	8.3	56,667	4,313	19.6	4,487	**4.68**	105.0	119	14.4	115.0	10.0	**71,680**
18.9	10.0	0.908	14.3	4.6	16,603					40.6	48.3	0.908	46.1	5.5	**21,002**

Compressor: ZPS51K4E-PFV

Heating Mode

TF-75-HACW-P-1T — **Nominal 6 ton** — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	W/W	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
26.0	15	16.8	22.2	3.8	29,942	5,106	23.5	5,349	**2.61**	104.0	125	16.8	109.7	5.7	**47,736**
-3.3	-9.4	1.060	-5.4	2.1	8,773					40.0	51.7	1.060	43.2	3.2	**13,987**
32.0	20	16.8	27.8	4.2	33,301	5,182	23.9	5,425	**2.77**	104.0	126	16.8	110.1	6.1	**51,356**
0.0	-6.7	1.060	-2.3	2.3	9,757					40.0	52.2	1.060	43.4	3.4	**15,047**
38.0	25	16.8	33.3	4.7	37,271	5,198	24.0	5,441	**2.98**	104.0	126	16.8	110.6	6.6	**55,381**
3.3	-3.9	1.060	0.7	2.6	10,920					40.0	52.2	1.060	43.7	3.7	**16,226**
44.0	30	16.8	38.7	5.3	42,601	5,237	24.1	5,480	**3.25**	104.0	126	16.8	111.2	7.2	**60,844**
6.7	-1.1	1.060	3.7	3.0	12,482					40.0	52.2	1.060	44.0	4.0	**17,827**
49.0	35	16.8	43.0	6.0	48,119	5,332	24.4	5,560	**3.51**	104.0	127	16.8	111.9	7.9	**66,684**
9.4	1.7	1.060	6.1	3.3	14,099					40.0	52.8	1.060	44.4	4.4	**19,538**
55.0	40	16.8	48.3	6.7	53,401	5,339	24.5	5,568	**3.79**	104.0	127	16.8	112.6	8.6	**71,991**
12.8	4.4	1.060	9.1	3.7	15,646					40.0	52.8	1.060	44.8	4.8	**21,093**
61.0	45	16.8	53.6	7.4	59,105	5,346	24.5	5,574	**4.08**	104.0	127	16.8	113.3	9.3	**77,717**
16.1	7.2	1.060	12.0	4.1	17,318					40.0	52.8	1.060	45.1	5.1	**22,771**
67.0	50	16.8	58.9	8.1	64,748	5,412	24.8	5,641	**4.34**	104.0	128	16.8	114.0	10.0	**83,587**
19.4	10.0	1.060	14.9	4.5	18,971					40.0	53.3	1.060	45.5	5.5	**24,491**

Compressor: ZPS60K4E-PFV

Heating Mode

TF-80-HACW-P-*S						Nominal 6 ton						R410a 60 Hz			
Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	USGPM	°F	°F	BTU/Hr	Watts	Amps	Watts	W/W	°F	°F	USGPM	°F	°F	BTU/Hr
°C	°C	L/s	°C	°C	Watts		***			°C	°C	L/s	°C	°C	Watts
26.0	15	16.8	22.3	3.7	29,901	6,208	32.1	6,451	**2.34**	104.0	125	16.8	110.1	6.1	**51,458**
-3.3	-9.4	1.060	-5.4	2.1	8,761		18.1			40.0	51.7	1.060	43.4	3.4	**15,077**
32.0	20	16.8	27.6	4.4	34,956	6,246	32.3	6,489	**2.56**	104.0	126	16.8	110.7	6.7	**56,643**
0.0	-6.7	1.060	-2.4	2.4	10,242		18.1			40.0	52.2	1.060	43.7	3.7	**16,596**
38.0	25	16.8	32.9	5.1	40,761	6,194	32.1	6,437	**2.83**	104.0	126	16.8	111.4	7.4	**62,270**
3.3	-3.9	1.060	0.5	2.8	11,943		18.0			40.0	52.2	1.060	44.1	4.1	**18,245**
44.0	30	16.8	38.2	5.8	46,150	6,070	31.8	6,313	**3.12**	104.0	126	16.8	112.0	8.0	**67,235**
6.7	-1.1	1.060	3.5	3.2	13,522		17.9			40.0	52.2	1.060	44.5	4.5	**19,700**
49.0	35	16.8	42.6	6.4	51,148	6,028	31.9	6,256	**3.38**	104.0	127	16.8	112.6	8.6	**72,087**
9.4	1.7	1.060	5.9	3.6	14,986		17.9			40.0	52.8	1.060	44.8	4.8	**21,121**
55.0	40	16.8	47.8	7.2	57,798	5,965	31.6	6,194	**3.71**	104.0	127	16.8	113.4	9.4	**78,523**
12.8	4.4	1.060	8.8	4.0	16,935		17.8			40.0	52.8	1.060	45.2	5.2	**23,007**
61.0	45	16.8	52.9	8.1	64,897	5,898	31.3	6,127	**4.08**	104.0	127	16.8	114.2	10.2	**85,394**
16.1	7.2	1.060	11.6	4.5	19,015		17.7			40.0	52.8	1.060	45.7	5.7	**25,020**
67.0	50	16.8	58.0	9.0	71,851	5,911	31.3	6,139	**4.41**	104.0	128	16.8	115.0	11.0	**92,391**
19.4	10.0	1.060	14.4	5.0	21,052		17.6			40.0	53.3	1.060	46.1	6.1	**27,070**
Compressor: ZP70KWE-PFV						***	230-1-60	208-3-60							

Table 24 - Heat Pump Electrical Information (208/230-1-60)

Model	Compressor		Fan	In/Outdoor Circulators	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Max A	Amps	Amps	Amps	ga
45	18.6	82	3.5	5.0	27.9	32.6	40	#8-3
55	23.6	96	4.0	7.0	35.4	41.3	50	#6-3
65	28.6	118	5.5	7.0	41.9	49.1	60	#6-3
75	30.4	150	6.5	7.0	44.7	52.3	60	#6-3
80*	35.7	148	7.0	7.0	50.5	59.4	70	#6-3

* Models are single stage

Table 25 - Heat Pump Electrical Information (208-3-60)

Model	Compressor		Fan	In/Outdoor Circulators	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Max A	Amps	Amps	Amps	ga
45	12.4	58	3.5	5.0	21.7	24.8	40	#8-4
55	15.0	88	4.0	7.0	26.8	30.6	50	#6-4
65	19.6	123	5.5	7.0	32.9	37.8	60	#6-4
75	21.2	123	6.5	7.0	35.5	40.8	60	#6-4
80*	25.0	149	7.0	7.0	39.8	46.1	60	#6-4

* Models are single stage

Table 26 - Heat Pump Electrical Information (220-1-50)

Model	Compressor		Fan	In/Outdoor Circulators	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Max A	Amps	Amps	Amps	ga
45*	15.0	67	3.5	5.0	24.3	28.1	40	#12-2
55*	17.7	98	4.0	7.0	29.5	33.9	50	#10-2
65*	27.3	153	5.5	7.0	40.6	47.4	60	#10-2
75*	32.9	176	6.5	7.0	47.2	55.4	80	#8-2

* Models are single stage

Table 27 - Heat Pump Electrical Information (380-3-50)

Model	Compressor		Fan	In/Outdoor Circulators	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Max A	Amps	Amps	Amps	ga
45	5.0	29	3.5	5.0	14.3	15.6	20	#12-4
55	7.1	41	4.0	7.0	18.9	20.7	25	#10-4
65	10.0	62	5.5	7.0	23.3	25.8	30	#10-4
75	10.9	62	6.5	7.0	25.2	27.9	40	#8-4
80*	11.8	74	7.0	7.0	26.6	29.6	40	#8-4

* Models are single stage

TABLE 28 - Plenum Heater Electrical Information

Heater Size	Electrical 230-1-60			Electrical 208-1-60			Electrical 220-1-50		
Size (kW)	Current (A)	Breaker (A)	Wire Size	Current (A)	Breaker (A)	Wire Size	Current (A)	Breaker (A)	Wire Size
7	29	40	#8	25	40	#8	27	40	#8
10	42	60	#6	36	50	#6	38	50	#6
15	63	80	#4	54	70	#4	57	80	#4
20	83	125	#3	72	90	#3	76	100	#3

Modular Parallel TF(H)-Series Aquastat Connection Diagram

Mode Description

The modular parallel design TF(H) series geothermal heat pump has three modes of operation as follows: air heating, air cooling and hydronic heating. The air heating and air cooling modes are controlled by the Thermostat while the hydronic heating mode is controlled by the Aquastat.

Mode Priority

The unit comes with a jumper across the PR terminals which sets the priority to air mode. To set hydronic mode as priority simply remove the jumper from the PR terminals. For two stage models, when operating on Stage 1 of the priority mode, if a signal is received on Stage 1 of the non-priority mode the unit switches to Stage 2 of the priority mode to satisfy the priority demand as quickly as possible. The unit then swithes to the non-priority mode to satisfy that demand. A Stage 3 (2 for single stage models) call from air mode (W2/E - Aux/Emergency) overides the hydronic mode regardless of priority selection.

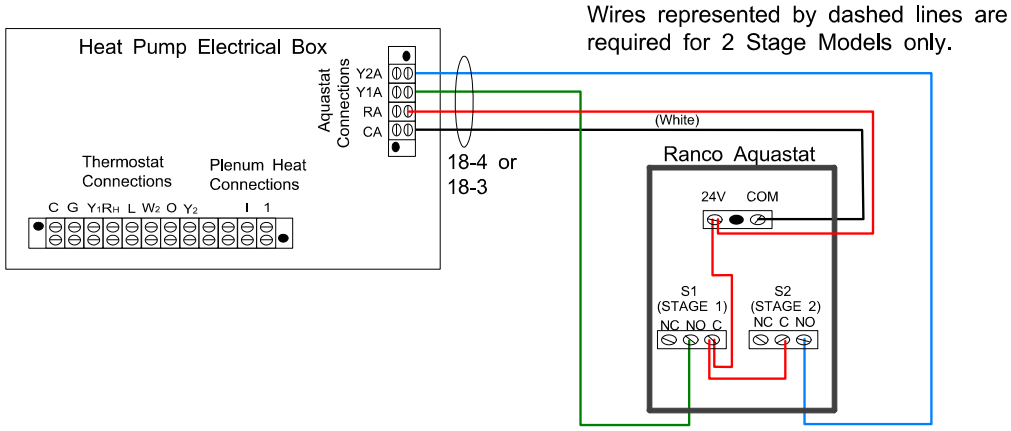
Aquastat Operation

The Aquastat is used to control the hydronicr heat mode of the modular parallel design TF(H) design geothermal heat pump. Stage 1 activates the heat pump in Stage 1 hydronic mode and Stage 2 activates the heat pump in Stage 2 hydronic mode(two stage models only) For two stage models, Stage 2 hydronic mode may also be activated by a Stage 1 air mode call if hydronic mode is selected as priority mode.

Aquastat Settings

The Aqustat controls Stage 1 and Stage 2 of the heat pump with it's Stage 1 and Stage 2 settings. These setpoints should be set accordingly. A typical installation could have Stage 1 set to 115F with a 5F differential and Stage 2 set to 110F with a 5F differential. Refer to the Aquastat instructions for information on how to set the Aquastat.

Aquastat Wiring Diagram



Aquastat Connections Description

Use 18-4 thermostat wire for two stag models or 18-3 for single stage models.
Connect CA from Heat Pump Electrical Box Aquastat Connections to COM in Aquastat
Connect RA from Heat Pump Electrical Box Aquastat Connections to 24V in Aquastat and C of Stage 1 (S1), and for two stage models also connect to C of Stage 2 (S2)
Connect Y1A from Heat Pump Electrical Box Aquastat Connections to NO of Stage 1 (S1) in Aquastat
For two stage modelsConnect Y2A from Heat Pump Electrical Box Aquastat Connections to NO of Stage 2 (S2) in Aquastat

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	05 FEB 10

Drawn By: Chris Geddes		Date: 05 FEB 10
Checked By: Chris Geddes		Date: 05 FEB 10
Approved By: Chris Geddes	(ENG)	Date: 05 FEB 10
Approved By	(MFG)	Date
Approved By		Date

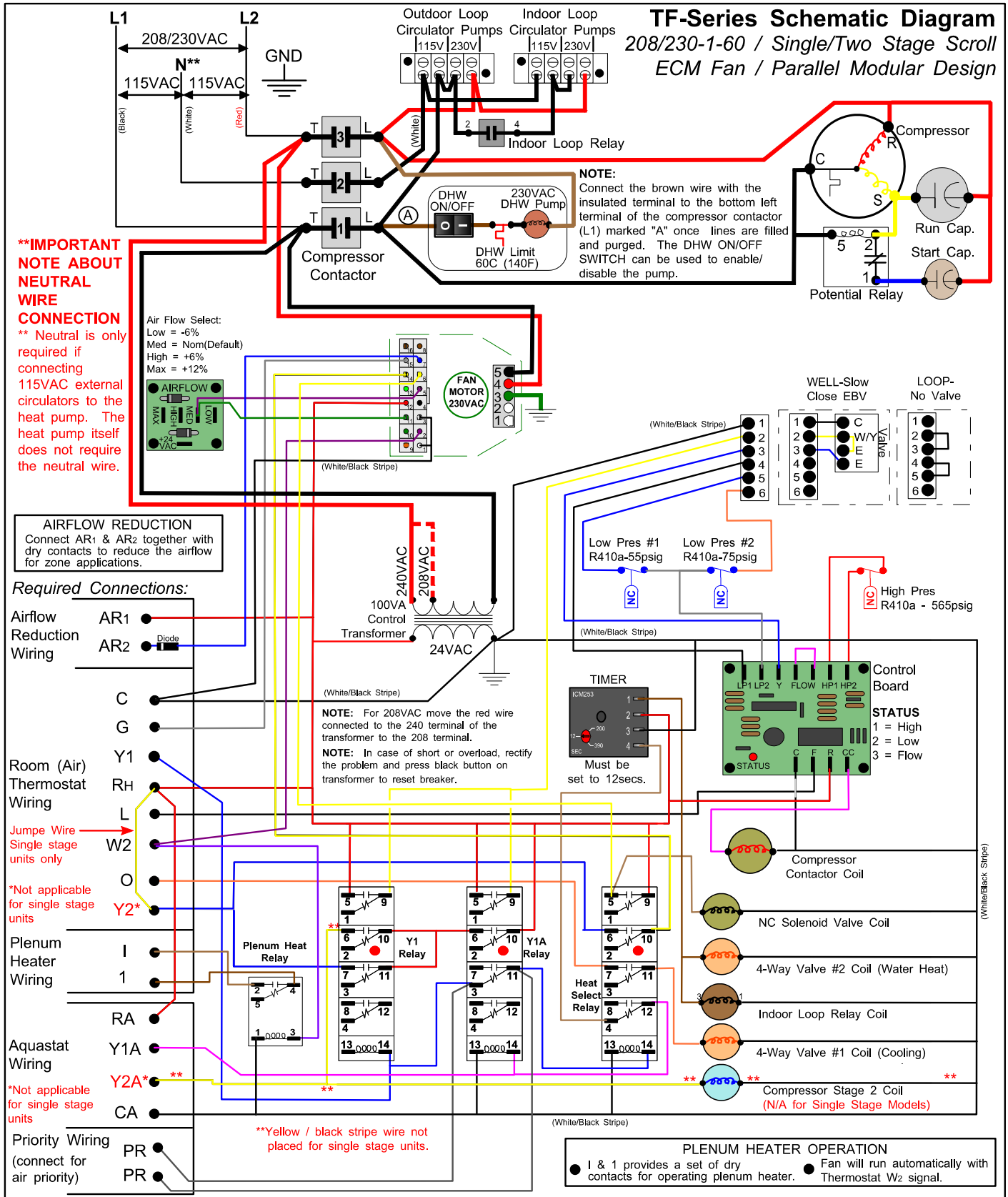
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Modular Parallel TF(H)-Series Two-Stage Aquastat Connection Diagram

Size	Drawing Number	REV	SHEET
A	001224CDG	01	1 of 1

TF-Series Schematic Diagram

208/230-1-60 / Single/Two Stage Scroll ECM Fan / Parallel Modular Design



REV	ECO #	IMPL BY	APVD BY	DATE
02	000217	C. GEDDES	C. GEDDES	01 JAN 2014
01	Initial Release	C. GEDDES	C. GEDDES	16 FEB 11

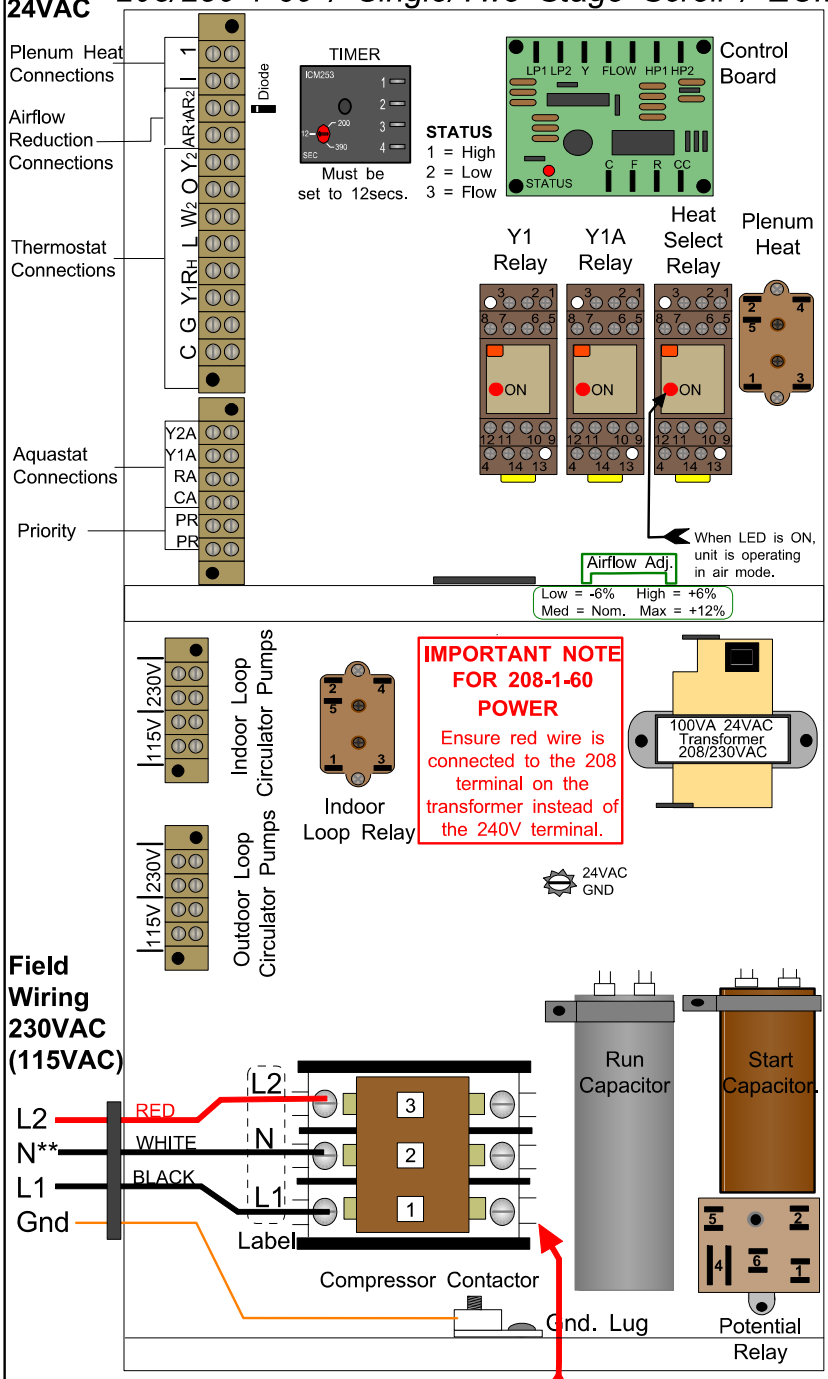
Drawn By	Chris Geddes	Date 18 APR 2011
Checked By	Chris Geddes	Date 18 APR 2011
Approved By (ENG)	Chris Geddes	Date 18 APR 2011
Approved By (MFG)		Date
Approved By		Date

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name	Size	Drawing Number	Drawing Rev	SHEET
TF-**-HACW-P-1*-**-*DE** Schematic Diagram	A	001453SCH	02	1 of 1

TF-Series Electrical Box Diagram

208/230-1-60 / Single/Two Stage Scroll / ECM Fan / Modular Parallel Design



Low Voltage Wiring (24VAC)

Thermostat Wiring

Use an 18-8 (7 for 1 stage) conductor cable. Connect the eight Thermostat Connections in the electrical box to the corresponding letters on the thermostat.

C - 24VAC Common
G - Fan
Y1 - Stage1 Heat/Cool (Compressor On/Off)
RH - 24VAC Hot
L - Trouble Indicator
W2 - Stage3 (2 for 1 stage) Heat (Plenum Heater)
O - Cooling (Reversing Valve)
Y2 - Stage2 (N/A for 1 stage) Heat/Cool (S2 Solenoid)

Airflow Reduction Wiring

Use an 18-2 conductor cable to connect Electrical Box AR1 AR2 to dry contacts. Fan speed will be reduced by 15% for zone applications.

Plenum Heater Wiring

Use an 18-2 conductor cable to connect Electrical Box I 1 to Plenum Heater C 1 (or I 1)

Aquastat Wiring

Use an 18-4 conductor cable. Connect the four Aquastat Connections Y1A, Y2A(two-stage models only), RA, and CA to the aquastat as per connection diagram 001224CDG-01 located on the front of the elctrical box cover.

Priority Selection

Air Priority - Connect a jumper between terminals PR and PR on terminal strip.
Water Priority - Remove the jumper between terminals PR and PR on terminal strip.

Outdoor / Indoor Circulator Pumps

REFER TO LABEL IN UNIT FOR MAX AMPS
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V
Connect "Gnd" to Gnd. Lug

208/230-115VAC CONNECTIONS		
Wire	**Colour**	**Contactor**
Line 2	Red	L2
Neutral**	White	N**
Line 1	Black	L1
Connect "Gnd" to Gnd. Lug		

****IMPORTANT NOTE ABOUT NEUTRAL WIRE CONNECTION**

** Neutral is only required if connecting 115VAC external circulators to the heat pump. The heat pump itself does not require the neutral wire.

Domestic Hot Water Circulator Pump Instructions:

If heat pump is to be operated without the hot water circulator connected to the water tank and flooded with water, remove the brown wire with the insulated terminal located here. **This pump is water lubricated and must not be run dry.** Once connected the external ON/OFF switch may be used to temporarily turn the pump off.

Heat Pump Electrical Service Requirements
208/230VAC Single Phase 60Hz (208/230-1-60)

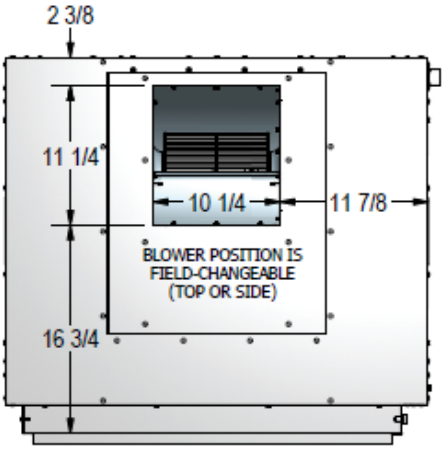
Model Size	Min. Circuit Ampacity	Min. Wire Gauge	TD Fuse or Breaker
45	35	8-3	40
55	41	6-3	50
65	49	6-3	60
75	52	6-3	60
80	59	6-3	70

REV	ECO #	IMPL BY	APVD BY	DATE
02	000217	C. GEDDES	C. GEDDES	01 JAN 2014
01	Initial Release	C. GEDDES	C. GEDDES	16 FEB 11

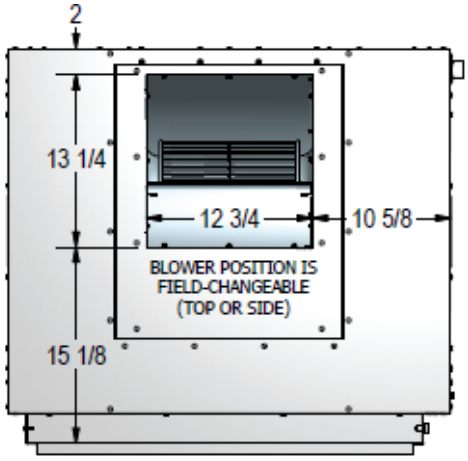
Drawn By	Chris Geddes	Date 18 APR 11
Checked By	Chris Geddes	Date 18 APR 11
Approved By (ENG)	Chris Geddes	Date 18 APR 11
Approved By (MFG)		Date
Approved By		Date

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name			
TF-**-HACW-P-1*-**-*DE** Electrical Box Diagram			
Size	Drawing Number	Drawing Rev	SHEET
A	001454ELB	02	1 of 1

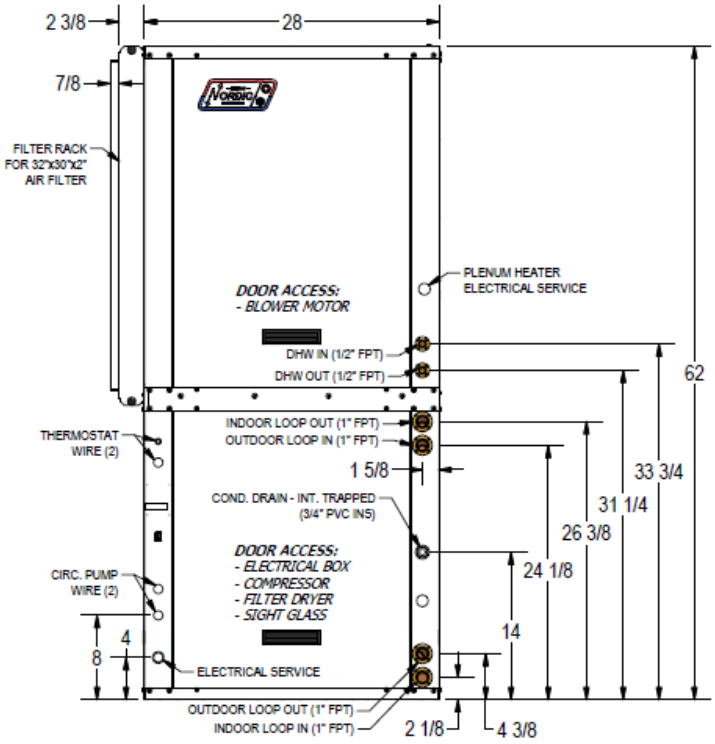


Top View (Size 45)

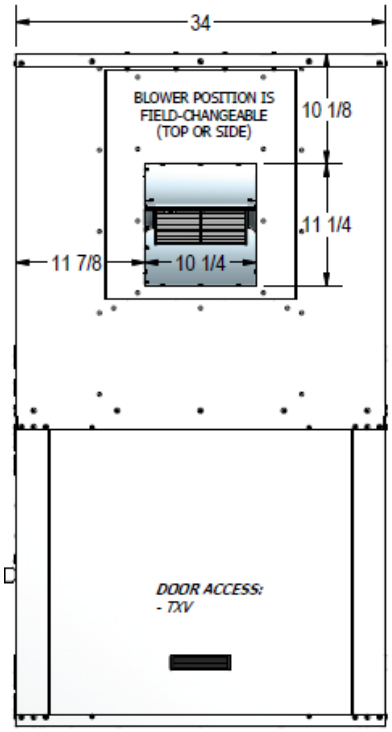


Top View (Size 55-80)

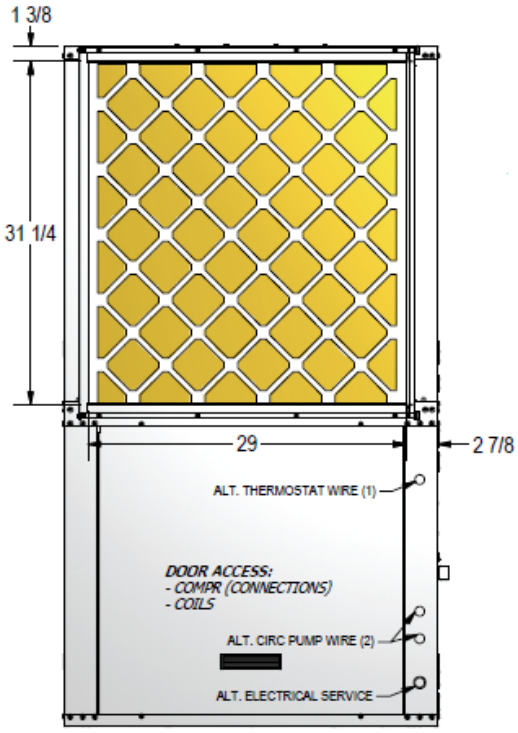
CASE DETAILS—LEFT RETURN



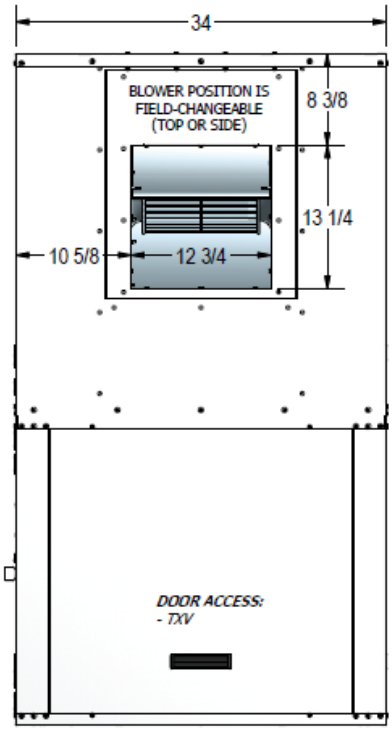
Front View—Left Return



Right Side View—Left Return (Size 45)

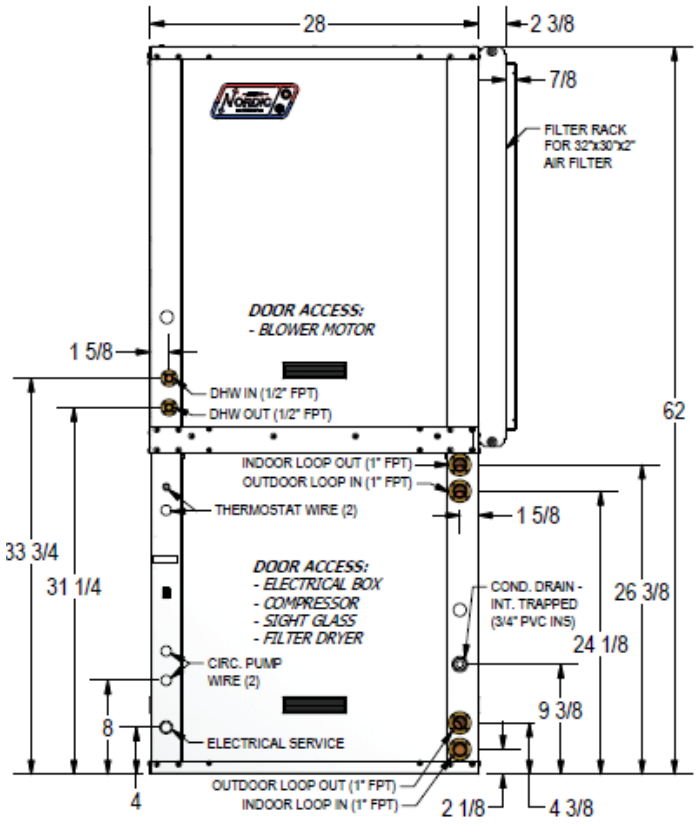


Left Side View– Left Return

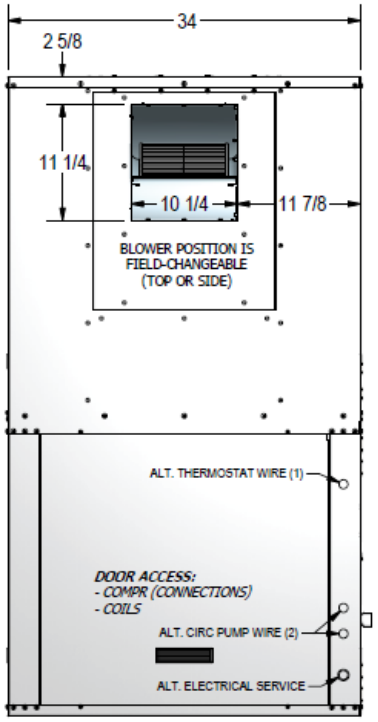


Right Side View—Left Return (Size 55-80)

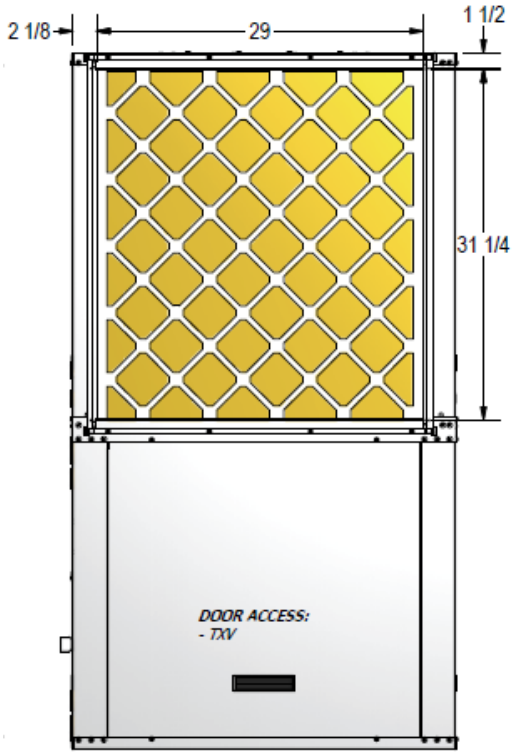
CASE DETAILS—RIGHT RETURN



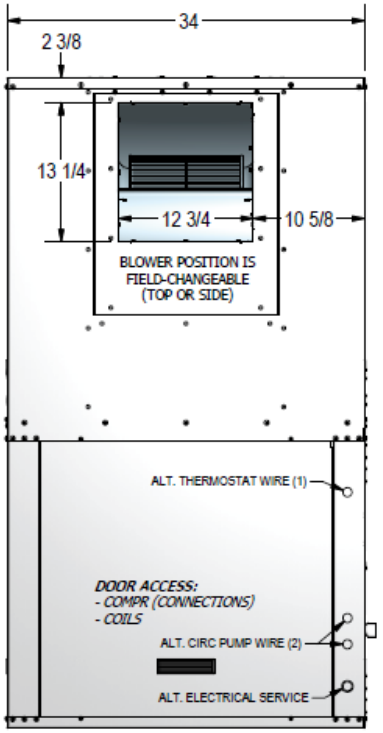
Front View—Right Return



Left Side View—Right Return (Size 45)



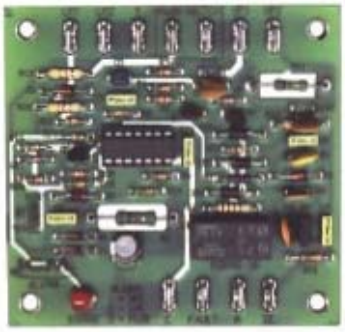
Right Side View– Right Return



Left Side View—Right Return (Size 55-80)

Lockout Protection Module

- **Anti-short cycle/lockout control**
- **Pressure/flow switch monitoring**
- **Alarm output during lockout**
- **5-minute anti-short cycle delay (5-second test mode)**
- **LED fault codes for lockout status**
- **Test mode for reduced test time**
- **Conformally coated for moisture protection**



Mode of Operation

The control will begin the 5-minute time delay upon a Y call from the thermosat. After the time delay expires, the compressor contactor will be energized as long as the high and low pressure switches are closed. If either switch is open after the delay expires, the compressor will not energize. If either switch opens while the compressor is energized, it will de-energize immediately and begin the anti-short cycle delay. The compressor will not be allowed to turn on again until the anti-short cycle delay expires and both pressure switches are closed. The flow switch will have a 30-second bypass timer in which the control will ignore an open flow switch for the first 30 seconds. If the flow switch remains open after the 30-second bypass timer expires, the unit will de-energize the compressor and begin the anti-short cycle delay. If the control experiences three high pressure, low pressure, or flow switch faults in a 60-minute period, it will lockout the compressor and energize the fault output. A manual reset of power will be required to reset the lockout condition.

The control has a status LED to indicate which type of fault or lockout has occurred. If a high pressure fault or lockout occurs, the status LED will blink once. If a low pressure fault or lockout occurs, the status LED will blink twice. If a flow switch fault occurs, the status LED will blink three times.

Specifications

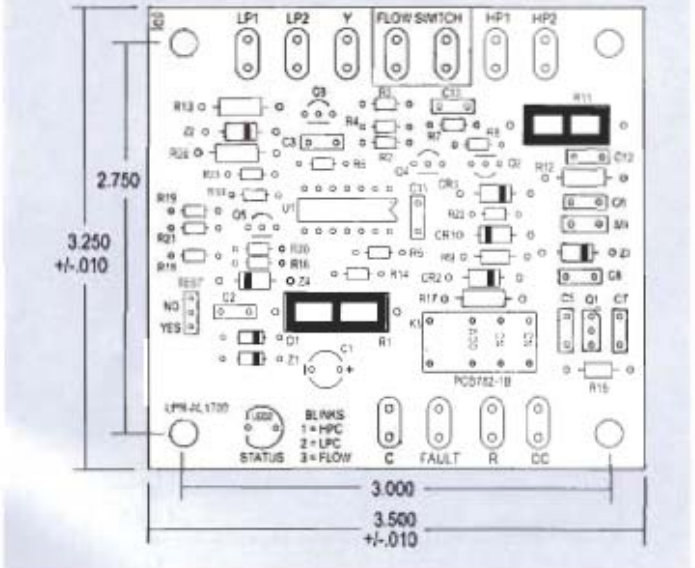
Input
- **Voltage:** 18 to 30 VAC
- **Frequency:** 50 to 60 Hz

Output
- **CC**
  - **Type:** Solid state (Triac)
  - **Rating:** 1 amp @ 30 VAC
- **Fault**
  - **Type:** Relay (SPDT) N.O.
  - **Rating:** 1 amp @ 30 VAC

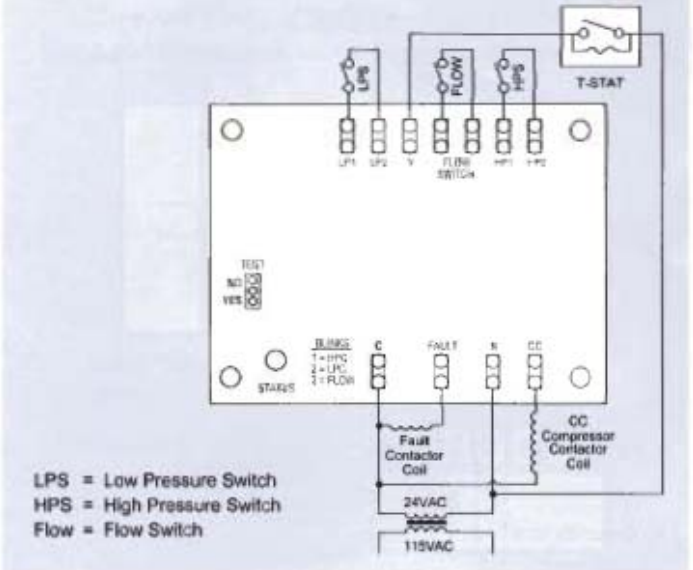
Time Delay
- **Anti-short cycle time:** 5-minutes fixed ±20% (5-second test mode)

Mechanical
- **Board dimensions:** 3.5" x 3.25" x 1"
- **Mounting:** Surface mount using (4) #6 or #8 screws

Dimensions



Wiring Diagram



APPENDIX B - ECM Fan Airflow Tables

NOMINAL AIRFLOW SETTING (MED)												
	STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
45	1200	566	1020	481	1030	486	876	413	672	317	571	270
55	1500	708	1275	602	1240	585	1054	497	840	396	714	337
65	1900	897	1615	762	1540	727	1309	618	1064	502	904	427
75	2100	991	1785	842	1660	783	1411	666	1176	555	1000	472
80	2400	1133	2040	963	N/A	N/A	N/A	N/A	1344	634	1142	539

-6% AIRFLOW SETTING (LOW)												
	STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
45	1128	532	959	453	968	457	823	388	632	298	537	253
55	1410	665	1199	566	1166	550	991	468	790	373	671	317
65	1786	843	1518	716	1448	683	1230	581	1000	472	850	401
75	1974	932	1678	792	1560	736	1326	626	1105	522	940	443
80	2256	1065	1918	905	N/A	N/A	N/A	N/A	1263	596	1074	507

+6% AIRFLOW SETTING (HIGH)												
	STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
45	1272	600	1081	510	1092	515	928	438	712	336	605	286
55	1590	750	1352	638	1314	620	1117	527	890	420	757	357
65	2014	951	1712	808	1632	770	1388	655	1128	532	959	452
75	2226	1051	1892	893	1760	830	1496	706	1400	661	1190	562
80	2544	1201	2162	1021	N/A	N/A	N/A	N/A	1425	672	1211	572

+12% AIRFLOW SETTING (MAX)												
	STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
45	1344	634	1142	539	1154	544	981	463	753	355	640	302
55	1680	793	1428	674	1389	655	1180	557	941	444	800	377
65	2128	1004	1809	854	1725	814	1466	692	1192	562	1013	478
75	2352	1110	1999	944	1859	877	1580	746	1317	622	1120	528
80	2688	1269	2285	1078	N/A	N/A	N/A	N/A	1505	710	1279	604

NOTES: Unit sizes 45 and 55 nominal value up to 0.50 inH2o, sizes 65, 75 and 80 up to 0.70inH2o
*To obtain the REDUCED airflow values use a dry contact to connect AR1 to AR2 on the terminal strip

INFORMATION TAKEN FROM DOCUMENT 000527INF-04

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LIMITED EXPRESS WARRANTY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd., a corporation registered in New Brunswick, Canada, ("MG") or its representatives, relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS RESIDENTIAL WARRANTY - PARTS
MG warrants its Residential Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for five (5) years from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below).
(4) Other accessories and parts built or sold by MG, when installed and purchased with MG Units, for five (5) years from the date of shipment from MG.
(5) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record or six (6) months from date of unit shipment from MG, whichever comes first.

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Residential Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

LIMITED EXPRESS RESIDENTIAL WARRANTY - LABOUR
This Limited Express Residential Labour Warranty shall cover the **labour** incurred by MG authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Residential Warranty only to the extent specifically set forth in the current **labour** allowance schedule "A" provided by MG's Warranty Department and only as follows:
(1) MG Units for two (2) years from the Warranty Inception Date.
(2) Thermostats, auxiliary electric heaters and geothermal pump modules built or sold by MG, when installed with MG Units, for two (2) years from the Warranty Inception Date.
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date.

Labour costs are not covered by this Limited Express Residential Warranty to the extent they **exceed** the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by MG authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Residential Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.
This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions.
(7) Products subjected to accident, misuse, negligence, abuse, fire, flood, lightning, unauthorized alteration, misapplication, contaminated or corrosive liquid or air supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel.
(8) Mold, fungus or bacteria damage
(9) Corrosion or abrasion of the product.
(10) Products supplied by others.
(11) Products which have been operated in a manner contrary to MG's printed instructions.
(12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of MG's products.
(13) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

Except for the limited **labour** allowance coverage set forth above, MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG's Limited Residential Warranty.
(2) The costs of **labour**, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if not covered by MG's Limited Express Residential Warranty.
(4) The costs of normal maintenance.

This Limited Express Residential Warranty applies to MG Residential Class products manufactured on or after February 15, 2010. MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEARS THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Residential Warranty is given in lieu of all other warranties. If, not withstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Residential Warranty.

LIMITATION OF REMEDIES In the event of a breach of the Limited Express Residential Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, mal-function or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY MG shall have no liability for any damages if MG's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call: Maritime Geothermal Ltd • Customer Service • PO Box 2555 • Petitcodiac, New Brunswick E4Z 6H4 • (506) 756-8135 • or e-mail to info@nordicghp.com NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province. Please refer to the MG Installation, Installation and Service Manual for operating and maintenance instructions.

An extended warranty option is also available. Please contact Maritime Geothermal Ltd. via the contact information in the previous paragraph for more information.